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Vol. VI. NEW YORK, NOVEMBER 28, 1885. No. 22.

THE Western Union Company is now credited with the intention of announcing a five-cent rate all over the country. Is that a bogey to scare Mr. Garrett with?

THE far-reaching enterprise of the Associated Press and the Canadian and American telegraph companies is well illustrated in the marvelous speed made in reporting the execution of Louis Riel. The particulars of this great telegraphic feat are recorded in another column.

WE record to-day the opening of a Van Depoele electric street car line at South Bend, Ind. It has our best wishes, and we are tempted to quote the language of a local newspaper scribe who says: "As soon as the system is successfully established in South Bend, the same system will be inaugurated in Minneapolis and Detroit. The science of the application of electricity as a motive power for street cars is an established fact. It is no longer an experiment. The bray of the festive mule must go. The electric dynamo furnishes a surer, cheaper and safer power to carry busy humanity from their homes to the marts of trade than the sting of the mule-driver's whip." Meanwhile, Mr. Cyrus Field and his friends are said to be even better satisfied with the Daft motor than is the inventor himself. A trial of the Daft is now promised on the New York Central Railroad.

THE FRANKLIN INSTITUTE has just elected six new honorary members, a distinction which is rarely bestowed. The recipients of this honor were: Louis Duncan, Ph.D., ensign U. S. Navy; Prof. William D. Marks, University of Pennsylvania; Geo. L. Anderson, lieutenant U. S. Army; J. B. Murdoch, lieutenant U. S. Navy; A. B. Wyckoff, lieutenant U. S. Navy, and George M. Ward, M.D. These names will be recognized as belonging to the gentlemen composing the committee which carried out the recent tests of lamps and dynamos for the Franklin Institute. The skill exhibited and labor involved in these tests leave no doubt of the fact that the honor conferred upon these gentlemen is well earned. The Franklin Institute has accomplished many good results in the past, and the future will no doubt see its activity and enterprise increased, if such were indeed possible.

THE near approach of the opening of Congress brings with it the usual rumors of a government monopoly of the American telegraphs. Senator So-and-so is just wild to "push" his little bill; Representative Somebody-else has hit upon a new idea, which he will "forward," and the old-time political brigade, with the typical ferocious mustaches and the usual hunger for more offices, are lustily clamoring for a telegraphic bureau. If these people could only act together they might, by the very fact of their unanimity, make some headway, but in view of the innumerable axes to grind, the Senator, the Representative and the brigade in general will have a hard time of it. Meanwhile the American people, believing that competition is the life of trade, will continue to advocate free telegraphs, untrammeled by the meddling policy of a "parental" government. The people can still take care of themselves.

ELECTRIC lighting has long since arrived at the stage of a permanent industry, and if anything were wanting to establish this fact it can be found in the large number of subsidiary industries it has created, as well as the impetus which has been given to others already existing. Steam engine building may be said to have been one of the principal industries affected by the advent of the electric light, which has admittedly had a great influence in bringing about the remarkable improvements developed in engines within the last few years. As an indication of the importance which steam engine builders attach to the electric lighting trade, it may be mentioned that the new catalogue of the Armington & Sims Engine Company contains a full list of sizes of engines and other details adapted to each of the various sizes of dynamos of some of our principal dynamo builders. These figures are an interesting study in themselves. Other instances might be mentioned, but it has been demonstrated sufficiently that the motives of those who criticise the stability and profitableness of electric lighting are far from pure, or else are the result of ignorance.

THERE is a movement to form a signal corps in connection with the National Guard, on the model of the United States Signal Service. It is argued that in times of riot or disturbance the usual means of communication, such as telegraph, telephone and district messenger service, are likely to be interrupted, whether by accident or design, when it will become necessary to fall back on the flag, torch, lantern or other apparatus. The idea is a good one. Perhaps underground wires would be more difficult to break or interrupt than aerial circuits, and if so, there is another good reason for burying the wires, after which the necessity for resorting to visual signaling or mere sound signaling would not be so great. Our own opinion is that the National Guard should not be restricted to a signal corps of the kind now suggested in high quarters, but should as far as possible have an electrician or electrical company to each corps, division or brigade. Why, for instance, should not the new signal men be able to operate such a balloon as that recently tried in England by Mr. Eric Bruce, for exchanging information at night by means of flashes of electric light?

ONE of our German contemporaries devoted recently some space to the experiments of one Procopius Diwisch, and details a number of interesting devices produced by him. Among them, the lightning rod occupies a prominent position, and Diwisch's biographer claims for him the priority of invention in this field, on the strength of the fact that he erected such a contrivance in his garden in 1754. So far as dates are concerned, Diwisch can by no means be counted as the original Jacob in the lightning rod business, as the thing had been done some time before by several others, and the idea of drawing sparks from clouds had been suggested by Franklin in 1749. Indeed, records show that before Diwisch's date two houses in Philadelphia were struck by lightning during a thunderstorm, and the one protected by lightning rods was not injured, while the other was severely damaged. We might enter more into the detail of this question, but priority claims on *modern* inventions must now be handled so frequently that our readers will pardon us for refusing to dig up dead issues. Justice must be done though the Heavens fall, but sometimes the wish is heard faintly that the Heavens would fall on a few of the men who had "done it before."

OUR article on another page detailing the claims of Antonio Meucci to the invention of the telephone, might almost be said to read like a painful romance. It seems well-nigh impossible that a finished invention, such as Meucci claims to have had as far back as 1864, should have remained in obscurity in spite of the strenuous efforts of the inventor to bring it before the public. Yet if we are to believe Mr. Meucci, such is the case. Meucci's claims, it must be admitted, bear the stamp of genuineness, in that his instruments show a series of stages of development, such as every invention passes through before reaching perfection, and the witnesses he cites in his affidavit filed in the case before Secretary Lamar, at Washington, would appear to substantitate the fact that he transmitted speech as he declares. It must be looked upon as another evidence of the fickleness of fortune that Mr. Grant was prevented from making the test on the District Telegraph lines in this city, for, if tried, the success or failure of Meucci's instrument would have been demonstrated. Still the question arises, why did not Meucci apply to other owners of lines, and the only answer he gives is his lack of knowledge of the English language, and his great poverty, which compelled him to stick to his work to gain a livelihood. Meucci's story, if true, is another example of the hardships experienced by pioneers in any line, and of mishaps, which will continue to be chronicled as long as there are inventors on earth.

WE must again refer to the criticisms on our electric light systems which a recent English visitor makes. They are evidently the impressions of an intelligent foreigner, who has perhaps not spent sufficient time among us to appreciate our peculiar institutions. Some of his suggestions will bear study, and it would be interesting to know why English arc lamps show up better than our own—if they do. Again Mr. Lever seems to think that our high tension arc systems are temporary, and questions whether the supply of thousands of arc lights to stores, etc., for advertising purposes, is a healthy development of the electric light. If statistics can be depended upon, this statement is uncalled for, since the arc light is steadily advancing and, although it is used in some cases for advertising purposes outside of buildings, its main increase is in the interior, where absolutely more light is required than had heretofore been available. Mr. Lever does not take kindly to the system of running incandescent lamps on arc circuits, and hopes it will not be extended. This wish is rather unkind, as the system has its *raison d'être* as well as any other, and the objection only arises from Mr. Lever's animosity to high tension currents, the spread of which he bewails. We also fail to see why better results should be obtained by placing the electric lighting in the hands of municipal authorities, which, Mr. Lever thinks, will eventually occur. However, the genial critic pays us a compliment in averring that our incandescent-lamp holders and fittings are superior to those of his own country, and this goes to prove that his criticisms are sincere, if not always deserved.

THE experiments in transmission of power, which M. Deprez has just concluded at Creil, are no doubt of interest, as they embrace the longest distance at which electric transmission has thus far been carried on. But we fail to see anything extraordinary in them, as would appear to a few of the Deprez disciples. The result which he has obtained is one which, with diligent study, might have been accomplished by many others besides M. Deprez, especially with the unlimited capital such as he had at his command. The question to be here solved is one only of degree, for the numerous electric railways now in operation demonstrate that the current can be economically transmitted for miles. But Deprez's results were obtained in a manner which is open to criticism, in that they do not truly represent an actual transmission. It will be noted that the generator and receiver were placed side by side, the line forming a loop around them. Providing the line were perfectly insulated, this arrangement would make no difference; but it is evident that any cross-leakage, due to defective insulation, would make a difference, shortening the effective length of the line proportionally. With the high electromotive force used by M. Deprez, it seems probable that leakage occurred, and that its effects may have conduced to the high results obtained. Again, the excitation of the fields of both generator and receiver by separate dynamos, greatly simplifies the problem, and shows that every advantage has been taken by the experimenter. However, M. Deprez has achieved a good point in lowering the speed of his machines, high E. M. F. being obtained by employing high-resistance armatures. But if, as M. Deprez claims, everything was in correct working order and the line perfectly insulated, we see no reason why the expense of erecting a costly loop circuit should have been incurred. An equivalent local resistance between the machines would have answered the same purpose exactly. The case can hardly be called one of transmission in the true sense of the word.

Experiments on Transmission of Power by Electricity between Paris and Creil.

BY M. MARCEL DEPREZ.

I am happy to announce to the Academy that the first experiments on the transmission of power by electricity have taken place, and that the results have been very satisfactory.

The length of the telegraphic line connecting the two stations is 56 kilometres (35 miles), but as the return of the current does not take place by the earth, it is really obliged to traverse a line of 112 kilometres of copper cable, equivalent in section to a single wire of 5 millimetres in diameter.

The total electric resistance of this cable at the temperature of 15° C. is 100 ohms.

The generating machine is at Creil. It has two rings revolving in two distinct magnetic fields, each composed of eight electro-magnets. Each ring has a resistance of 16.5 ohms and an external diameter of 0.78 metre.

The current produced by this machine was utilized at La Chapelle by two receiving machines, situated at some hundreds of metres from each other. Only one of these receivers is at present completed. It possesses, like the generator, two rings; they have each 0.58 metre exterior diameter and an electric resistance of 18 ohms.

The experiments, begun on October 17th, took place on a looped circuit; that is, the generating and receiving machines were placed side by side, as took place in the experiments made in March, 1883, in the works of the Railway du Nord, by a Commission nominated by the Academy. The objections which certain persons have raised to this manner of experimenting, which is much better adapted for scientific verification than the transmission to a distance, have been declared groundless by Tresca, with the reservation that we take, be it well understood, all the necessary precautions for measuring, during the experiment itself, the real resistance of the line, which has been actually done.

Between the generator and the steam-engine which sets it in motion there is introduced a very exact dynamometer, analogous to White's dynamometer, which inscribes at each instant upon a band of paper the mechanical work absorbed by the generator. This dynamometer has been studied by M. Contamin, the engineer of the Northern Railway of France.

The recipient is fitted with a Prony brake, in which the heating of the friction pulley is rendered impossible by means of a circulation of water. This brake remains in perfect equilibrium for entire hours. Buss tachymeters show at each instant the speed of the generator and of the receiver. These speeds, however, remain constant during the entire duration of an experiment.

We have, therefore, all the elements necessary for determining the mechanical work absorbed by the generator as well as that reproduced by the receiver.

As for the electrical measurements, they have been taken by means of three galvanometers, perfectly graduated, and which show the difference of potential at the brushes of the generator, the difference of potential at the brushes of the receiver, and the intensity of the current traversing the two machines and the line. Two other instruments, lastly, serve for measuring the intensity of the currents produced by small exciting machines, used for producing the magnetic fields of the generator and the receiver. The indications of all these instruments are of a great exactitude.

I will give in a future communication very complete tables, containing all the electrical and mechanical data of the experiments conducted either by M. Collignon, chief engineer of bridges and highways, or by myself. For the present I will content myself with giving the results of one of the experiments of the Commission, and of another experiment made two days afterwards in the presence of M. Sartiaux, sub-inspector of the Northern Railway of France and engineer delegated by the commission of experiments.

FIRST EXPERIMENT.

	Generator.	Receiver.
Speed in rev. per minute	190	248
Electromotive force, direct or inverse	5469 volts.	4242 volts.
Intensity of current	7.21 amp.	7.21 amp.
Work in magnetic field (in horse-power)	9.20	3.75
Electrical work (in horse-power)	53.59	41.44
Mechanical work measured with the dynamometer or the brake (horse-power)	62.10	35.10

EFFICIENCY.

Electrical	77 per cent.
Industrial mechanical	47.7 "

SECOND EXPERIMENT.

	Generator.	Receiver.
Speed per minute	170	277
Electromotive force	5717 volts.	4441 volts.
Intensity of current	7.20 amp.	7.20 amp.
Work in magnetic field	10.30	3.80
Electrical work	55.90	43.4
Mechanical work (measured with the dynamometer or the brake)	61	40

EFFICIENCY.

Electrical	78 per cent.
Industrial mechanical	53·4 "

It will be seen, and it is to this point that I desire to draw attention, that a useful work of 40 horse-power has been developed by the receiver with an industrial yield of 50 per cent., the speed of the generator being only 170 evolutions per minute, and that of the receiver 277. The electromotive force of the generator was about 5,700 volts. In other experiments it has exceeded 6,000 volts. These machines, therefore, develop considerable electromotive forces with very low angular velocities. It will be remarked, also, that the receiver, though having rings of only 0.50 metre in diameter, and being traversed by a current of only 7 ampères, developed a useful mechanical work of 648 kilogrammetres, without any appreciable heating. These are conditions which hitherto have not been realized.

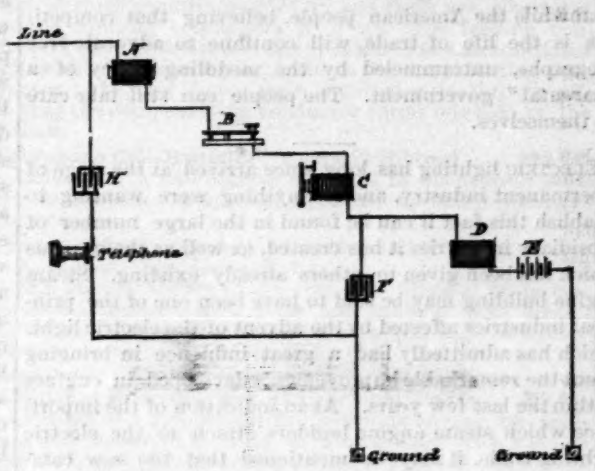
I cannot conclude this note without mentioning the persons whose assistance has rendered these costly experiments possible; above all, Dr. Herz, editor of *La Lumière Electrique*, who for two years has defended with the greatest energy, and by all the means in his power, the cause of the electric transmission of force to great distances, and thanks to whom, I have been able to undertake the experiments of Munich, of the Northern of France, and of Grenoble.

The present experiments, the first results of which I have laid before the Academy, have been made with the assistance of MM. de Rothschild.—*Comptes Rendus.*

Simultaneous Telegraphy and Telephony.

To the Editor of The Electrical World:

SIR: As it may be of interest to your readers, I give a brief detail of a successful test of simultaneous telegraphy and telephony over the same wire. The test was made by Mr. L. L. Doane, Secretary-Treasurer of the New Westminster (B. C.) Telephone Company and myself, between this city and Granville—a distance of twelve miles—over the telegraph line, closed circuit; Morse system. The telephones used were those invented by M. Van Rysselberghe, of Brussels. In making the test we used extra electro-magnets and condensers as given in THE ELECTRICAL WORLD of May 23 last, but as the diagram in that issue



SIMULTANEOUS TELEGRAPHY AND TELEPHONY—CLOSED CIRCUIT.

appears to be intended to be made on open circuit telegraph system, our connections were made somewhat different, as will be seen by the diagram which I inclose. Mr. Doane and myself have gone to a great deal of trouble and expense to make a successful test, and if we are deserving of any mention for the interest we have taken in the matter we would be pleased to receive it through the columns of THE ELECTRICAL WORLD.

Would you be good enough to inform me if the test has ever before been successful over closed circuit system in America?

S. T. MACKINTOSH,
Manager Dominion Government Telegraph and Signal Service.

NEW WESTMINSTER, B. C., Oct. 21, 1885.

[The Van Rysselberghe system has been put in operation in South America within a short time; but we are unable to say whether on closed or open circuit. Mexico, we believe, has also taken up the subject.—EDS. E. W.]

Our Lights as Others See Them.

The interesting remarks of Mr. Charles Lever, who gives his impressions on electric lighting in this country, continue to appear in our London contemporary, the *Electrical Review*. After referring to the lack of individuality in our systems, Mr. Lever says:

The only attempt at striking out into a new field simply lies in the fact that one or two systems employ a small current with a long arc, whilst the others use a heavy current and a short arc. In the one case we have a light with a tendency to give out disagreeable blue rays, in the other a pleasant light accompanied by the usual hissing noise and occasional flickering. There is no happy medium. No experimenting appears to have been done in order to ascertain which is the most suitable current to use with a given diameter of carbon, and what is the proper length of arc to work with in order to give the best results. The fact that the positive carbon ought to have a well defined crater appears to have been overlooked. It is even rare to find an ammeter in circuit with the lamps in order to see that the right current is passing through them. Evidently it matters little whether the lamps are hissing or flickering so long as the lights are kept burning. That the lights can be depended upon is, however, shown by the fact that the gas is very rarely kept burning where such arc lights are in use, and where the gas is already laid on. The fact of so many copper-coated carbons being used in the arc lamps has, no doubt, a great deal to do with the unsteadiness of the lights. * * * Outside of this carbon question it should be pointed out that the lamps themselves are by no means as regular in adjusting the carbons, or feeding, as those we are acquainted with in this country. * * *

Of course it should be stated that there are arc light circuits many miles in length in the United States, and this high tension system admirably fulfills the requirements *temporarily*. The word temporarily is here used advisedly, for it is a question whether the supply of thousands of arc lights to stores, etc., for advertising purposes alone, can be considered a healthy development of the electric light. Even the manner in which such installations are carried out, shows them to be of a temporary character. There are many people in the United States who have tried these arc lights for advertising purposes, and have discontinued them, and, on the other hand, there are others who stick to them when they find it pays them to do so.

Although the incandescent lamps themselves are no more efficient in America than they are here, yet, on the whole, incandescent light installations are there carried out in a much better manner than those in this country. In the States we don't find manufacturers claiming an efficiency of 2½ watts per candle-power, but they supply good, substantial, and durable lamps, giving an honest sixteen candle-power. Neither do we find lamps of different voltage, some almost ready to burst with brightness, others dull with redness, in their installations, but lamps of uniform brilliancy. Probably this fact is to be attributed to the better methods of gauging filaments in America. That attention to detail, which has been omitted in arc lighting, has been bestowed in its entirety on incandescent lighting. The incandescent lampholders and fittings in the United States are altogether more substantial than those in England. The fact is that we want, in our incandescent light installations, more of the substantial and less of the flimsy, more of the practical and less of the theoretical, and more of the actual and less of the 105 per cent. efficiency business.

As regards working arc and incandescent lights together, it is an unfortunate thing that we, in England, have already advocates and admirers of the high tension supply system. During the past two years, a system has cropped up in the United States, whereby incandescent lamps are worked on the same circuit as the arc lights by means of high tension currents. An automatic arrangement is provided with each incandescent lamp, so that in the event of said lamp giving out, a resistance equivalent thereto is thrown in circuit. It is a system which has not made much headway, and it is to be hoped that it never will. Notwithstanding the theoretical "bosh" which has been put forth by the advocates of the high tension system in this country, the practical electrician knows perfectly well that this is not the field to work in, if we are to make a success of our future electric light supply stations. And, when these (*low tension*) lighting stations have developed into undertakings of any magnitude, the supply of electricity must eventually fall into the hands of the municipal authorities—as in the case of gas and water undertakings—in order to secure the best results for the public benefit.

A Modification of the Bunsen Photometer.

All who have occasion to use the Rudorf modification of the Bunsen photometer, in which the screen bisects the angle between two mirrors set with an angle of 140° between them for actual measurement, have no doubt met with the common difficulty of placing the screen exactly within certain limits.

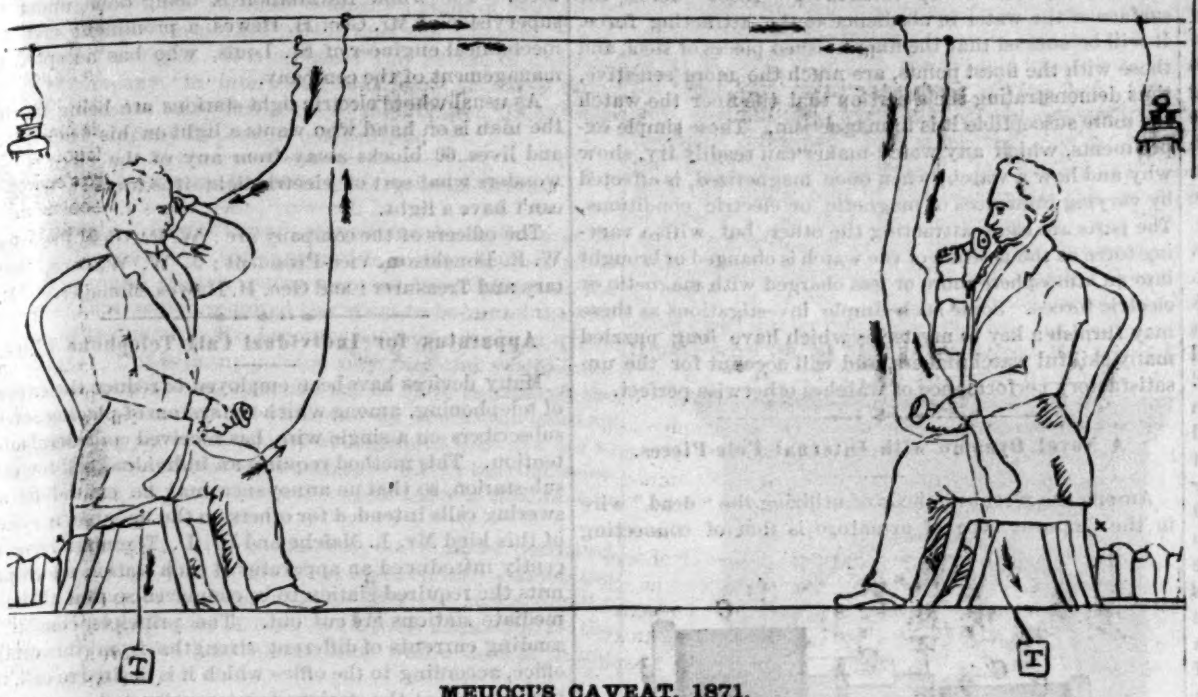
That is, after it has been set, it is possible to change its position considerably without altering to an appreciable extent the appearance of the spot. And again, where using, for instance, the constant-level Argand lamp to measure the intensity of the light of an arc lamp employing a screen with the ordinary grease-spot, the difference in color of the two lights proves a source of annoyance and error.

These defects are happily remedied in a modification of the Rudorf screen by an accomplished young officer, Lieutenant Millis, of the United States Corps of Engineers, and its perfect applicability is only equaled by its simplicity.

The ordinary Bunsen screen, as is well known, consists of a ground of white paper doubled, in which, at the centre of the screen, is cut a circular hole which is closed by a single thickness of paraffined paper pressed between two layers of white paper. The modification consists simply in placing from one to four thicknesses of paraffined paper, according to the strength of the light to be tested, between the white sheets, and where these sheets appear at the opening the paraffined paper has a circular hole cut in it concentric with that of the white paper, its diameter being about one-third that of the latter. By this change the effect of color seems to be eliminated, and in the reflected images, when the screen is at its proper position, we have an intense black centre in relief against a white ground. A slight movement of the screen along the bar alters this effect, and thus the utmost nicety of adjustment is rendered possible.

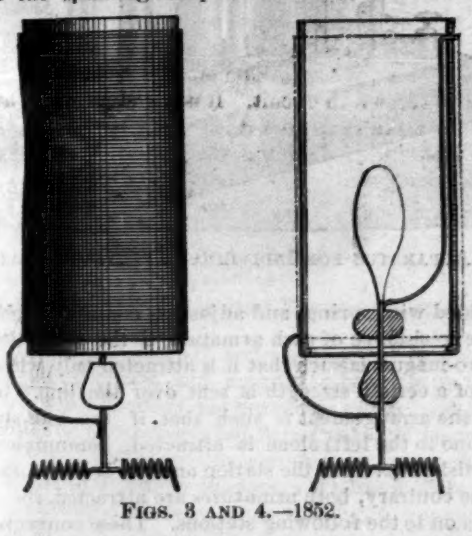
Meucci's Claims to the Telephone.

Our readers have already been informed through these columns that, notwithstanding the refusal of the Attorney General, Mr. Garland, to institute suit for the nullification of the Bell patent, application has again been made by the Globe Telephone Co., of this city, the Washington Telephone Co., of Baltimore, and the Pan Electric Co. These applications have been referred to the Interior Department and Patent Office for examination, and upon their report the institution of the suit depends. The evidence which the companies above mentioned have presented includes not only the statement of Prof. Gray and the circumstances connected with his caveat, but brings out fully, for the first time, the claims of Antonio Meucci.



MEUCCI'S CAVEAT, 1871.

The latter evidence is intended to show that Meucci invented the speaking telephone not only before Bell, but that he antedated Reis by several years. In a recent interview with Meucci we obtained a brief history of his life and of his invention, which will, no doubt, interest our readers. Meucci, a native of Italy, was educated in the schools of Florence, devoting his time as a student to mechanical engineering. In 1844 he gave considerable attention to the subject of electricity, and had a contract with the government of the Island of Cuba to galvanize materials used in the army. While experimenting with electricity he read the works of Becquerel, Mesmer and others, who treated largely of the virtues of electricity in the cure of disease. Meucci made experiments in this direction, and at one time thought that he heard the sound of a sick person's voice more distinctly than usual when he had the spatula connected with the wire and battery in his mouth.



FIGS. 3 AND 4.—1852.

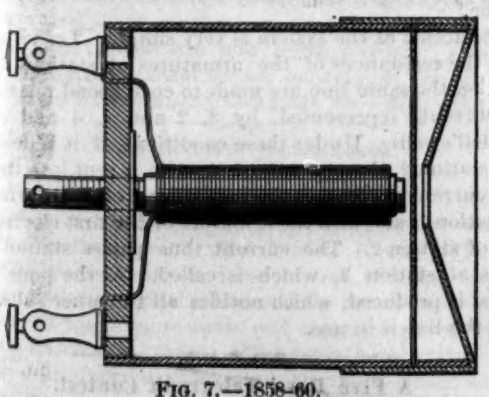


FIG. 7.—1858-60.

The apparatus he used for this purpose is shown in Fig. 1. It consisted of an oval disc or spatula of copper attached to a wire which was coiled and supported in an insulating handle of cork. To ascertain that he was able to hear the sound, he covered the device with a funnel of pasteboard, shown in the adjoining figure, and held it to his ear and thought that he heard the sound more distinctly.

These instruments were constructed in 1849 in Havana, where Meucci was mechanical director of a theatre. In May, 1851, he came to this country, and settled in Staten Island, where he has lived ever since. It was not until a year later that he again took up his telephonic studies, and then he tried an arrangement somewhat different from the first. He used a tin tube, Figs. 3 and 4, and covered it with wire, the ends of which were soldered to the tongue of copper. With this instrument, he states, he frequently conversed with his wife from the basement of his house to the third floor, where she was confined as an invalid.

Continuing his experiments, he conceived the idea of using a bobbin of wire with a metallic core, and the first instrument he constructed on this idea is shown in Fig. 5.

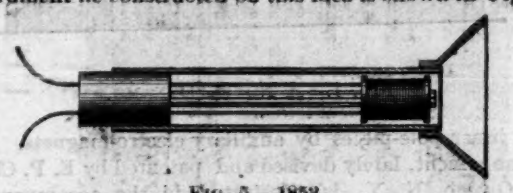


FIG. 5.—1853.

It consisted of a wooden tube and pasteboard mouthpiece, and supported within the tube was a bundle of steel wires, surrounded at their upper end by a bobbin of insulated wire. The diaphragm in this instrument was an animal membrane, and it was slit in a semicircle so as to make a flap or valve which responded to the air vibrations. This was the first instrument in which he used a bobbin, but the articulation naturally left much to be desired, on account of the use of the animal membrane. Meucci fixes the dates from the fact that Garibaldi lived with him during the years 1851-54, and he remembers explaining the principles of his invention to the Italian patriot.

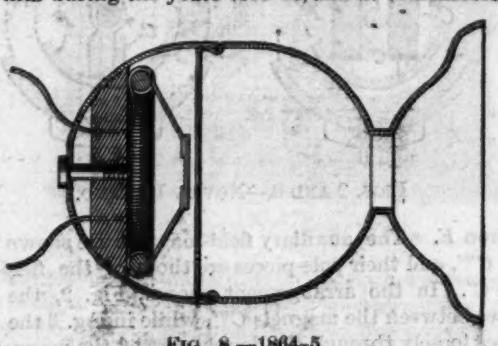


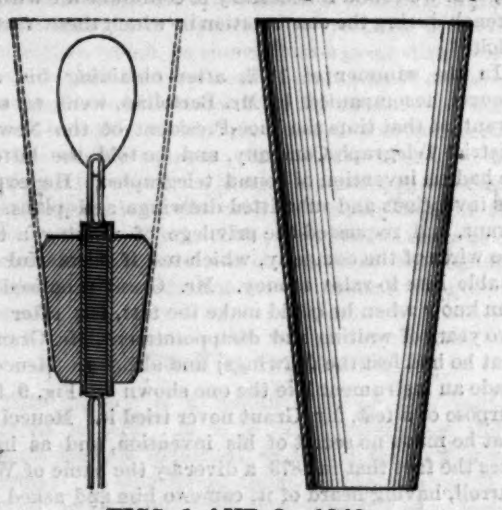
FIG. 8.—1864-5.

After constructing the instrument just described, Meucci devised another during 1853-1854. This consisted of a wooden block with a hole in the centre which was filled with magnetic iron ore, and through the centre of which a steel wire passed. The magnetic iron ore was surrounded by a coil of insulated copper wire. But an important improvement was introduced here in the shape of an iron diaphragm. With this apparatus greatly improved effects were obtained.

In 1856 Meucci first tried, he says, a horseshoe magnet, as shown in Fig. 6, but he went a step backward in using an animal membrane. He states that this form did not talk so well as some which he had made before—as might be expected.

During the years 1858-1860 Meucci constructed the instrument shown in Fig. 7. He here employed a core of tempered steel magnetized, and surrounded it with a large coil. He used an iron diaphragm, and obtained such good results that he determined to bring his invention before the public. His national pride prompted him to have the invention first brought out in Italy, and he intrusted the matter to a Mr. Bendalari, an Italian merchant, who was about to start for that country. Bendalari, however, neglected the matter, and nothing was heard of it from that quarter. At the same time Meucci described his invention in *L'Eco d'Italia*, an Italian paper published in this city, and awaited the return of Bendalari.

Meucci, however, kept at his experiments with the object of improving his telephone, and several changes of form were the result. Fig. 8 shows one of these instruments constructed during 1864-1865. It consisted of a ring of iron wound spirally with copper wire, and from two opposite sides iron wires attached to the core supported an iron button. This was placed opposite an iron diaphragm, which closed a cavity ending in a mouthpiece. He also constructed the instrument which is shown in Fig. 9, and which, he says, was the best instrument he had ever constructed. The bobbin was a large one, and was placed in a soap-box of box-wood, with magnet core and iron diaphragm. Still seeking greater perfection, Meucci, in 1865, tried the bent horseshoe form, shown in Fig. 10, but found it no improvement, and, although he experimented up to the year 1871, he was not able to obtain any better results than the best of his previous instruments had given.



FIGS. 1 AND 2.—1849.

When Meucci arrived in this country he had property valued at $20,000, and he entered into the brewing business and into candle-making, but he gradually lost his money, until in 1868 he found himself reduced to little or nothing. To add to his misery he had the misfortune of being on the Staten Island ferry-boat "Westfield" when

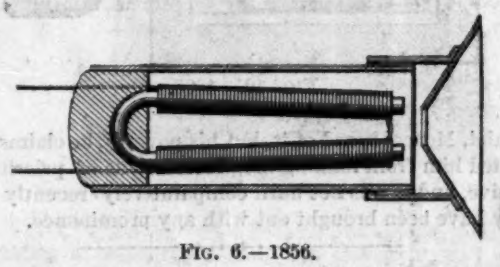


FIG. 6.—1856.

the latter's boiler exploded with such terrible effect in 1871. He was badly scalded, and for a time his life was despaired of. After he recovered he found that his wife, in their poverty, had sold all his instruments to John Fleming, a dealer in second-hand articles, and from whom parts of the instruments have recently been recovered.

With the view of introducing his invention, Meucci now determined to protect it by a patent, and having lost his instrument he had a drawing made according to his sketches by an artist, Mr. Nestori. This drawing he showed to several friends, and took them to Mr. A. Bertolino, who went with him to a patent attorney, Mr. T. D. Stetson, in this city. Mr. Stetson advised Meucci to apply for a patent, but Meucci, without funds, had to content himself with a caveat. To obtain money for the latter he formed a partnership with A. Z. Grandi, S. G. P. Bugugliо and Ango Tremeschin. The articles of agreement between them, made Dec. 12, 1871, credit Meucci as the inventor of a speaking telegraph, and the parties agree to furnish him with means to procure patents in this and

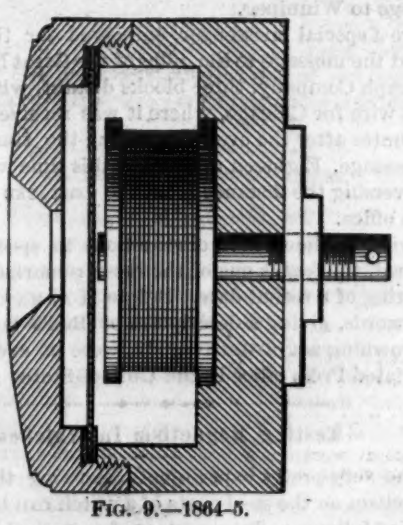


FIG. 9.—1864-5.

other countries, and to organize companies, etc. The name of the company was "Teletrofono." They gave him $20, with which to procure his caveat, and that was all the money he ever received from this source.

The caveat which Meucci filed contained the drawing made by Nestori, and as shown in the cut, which is a facsimile, represents two persons with telephones connected by wires and batteries in circuit. The caveat, however, does not describe the invention very clearly; it describes the two persons as being insulated, but Meucci claims that he never made any mention of insulating persons, but only of insulating the wires. To explain this seeming incongruity, it must be stated that Meucci communicated with his attorney through an interpreter, as he was not master of the English language; and even at the present time he understands and speaks the language very poorly, so much so, that we found it necessary to communicate with him in French during the conversation in which these facts were elicited.

In the summer of 1872, after obtaining his caveat, Meucci, accompanied by Mr. Bertolino, went to see Mr. Grant, at that time the Vice-President of the New York District Telegraph Company, and he told the latter that he had an invention of sound telegraphs. He explained his inventions and submitted drawings and plans to Mr. Grant, and requested the privilege of making a test on the wires of the company, which test if successful would enable him to raise money. Mr. Grant promised to let him know when he could make the test, but after nearly two years of waiting and disappointment, Mr. Grant said that he had lost the drawings; and although Meucci then made an instrument like the one shown in Fig. 9 for the purpose of a test, Mr. Grant never tried it. Meucci claims that he made no secret of his invention, and as instance cites the fact that in 1873, a diver by the name of William Carroll, having heard of it, came to him and asked him if he could not construct a telephone so that communication could be maintained between a diver and the ship above. Meucci set about to construct a marine telephone, and he showed us the sketch of the instrument in his memorandum book, which dates from that time and contains a number of other inventions and experiments made by him.

When Professor Bell exhibited his invention at the Cen-

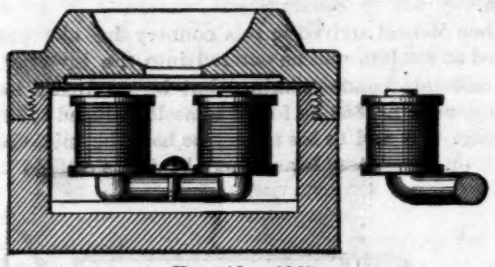


FIG. 10.—1865.

tennial, Meucci beard of it, but his poverty, he claims, prevented him from making his protestations of priority effective, and it was not until comparatively recently that they have been brought out with any prominence.

A News-Gathering Feat.

A statement has been made in Chicago of the work done by the Associated Press in transmitting the news of the execution of Louis Riel at Regina, on the 16th inst. A representative of the Associated Press was sent from Chicago to Regina, which is located on the Canadian Pacific Railway, 400 miles west from Winnipeg. The execution occurred at the barracks of the mounted police force, four miles distant from the telegraph station. The famous rebel was hanged at 8.23 A. M., mountain time, or 9.23 Chicago time. The bulletin announcing the event was carried by a mounted courier to the telegraph office of the Canadian Pacific Telegraph Company, which wired the message to Winnipeg.

Here a special messenger, employed for that purpose, carried the message to the office of the Great Northwestern Telegraph Company, three blocks distant, who put it on a direct wire for Chicago, where it was received at 10.06, or 43 minutes after the event, including the transmission of the message. Eighteen minutes of this time was consumed in traversing the distance from the barracks to the telegraph office.

In view of the natural obstructions to speed which intervened, the feat is one of the most remarkable in news gathering of a recent date. Before 11 A. M., Chicago time, 2,000 words, giving a description of Riel's last hours and the crowning act of the tragedy, were in every principal Associated Press office in the United States and Canada.

Testing Magnetism in Watches.

Some very pretty experiments showing the effects of magnetism on the steel parts of a watch can be very easily made as follows: Take a glass of water, a balance-wheel and an ordinary magnet, say 12-inch horseshoe. The balance-wheel will float if carefully laid on the surface of the water. Bring the magnet near it and it will be attracted, repelled or revolved as the different poles are brought to bear, and when the magnet is removed to a distance the balance will arrange itself in the north and south polarity, the same as a compass needle. A hair-spring will float in the same way, and is much more sensitive to the magnetic influence—the delicate lines of steel are alive to the slightest change of polarity, as exhibited by the magnet, and if left free it will immediately arrange itself in the north and south line. Also the fork, the regulator or any of the flat pieces of steel can be made to float (care being taken that they are dry and carefully laid upon the water), and their antics under the magnetic influence are very amusing, appearing "like things of life" as they "'bout face," turn sharp corners or "scoot" across the surface of the water in obedience to the attracting force. It will be noticed that the finer finished pieces of steel, and those with the finest points, are much the more sensitive, thus demonstrating the assertion that the finer the watch the more susceptible it is to magnetism. These simple experiments, which any watch-maker can readily try, show why and how a watch, when once magnetized, is affected by varying influences of magnetic or electric conditions. The paris are each attracting the other, but with a varying force as the position of the watch is changed or brought into an atmosphere more or less charged with magnetic or electric forces. Some such simple investigations as these may furnish a key to mysteries which have long puzzled many skillful watchmakers, and will account for the unsatisfactory performance of watches otherwise perfect.

A Novel Dynamo with Internal Pole-Pieces.

Among the recent methods of utilizing the "dead" wire in the Gramme type of armature is that of connecting

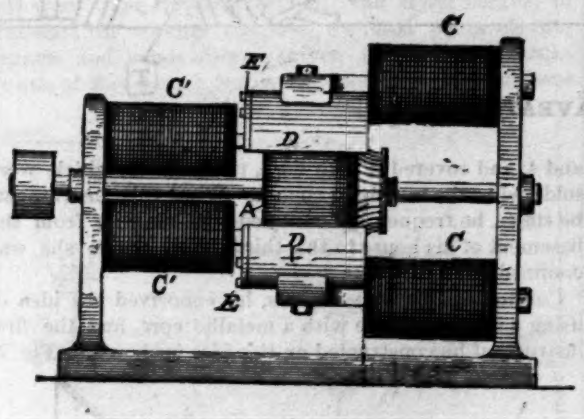
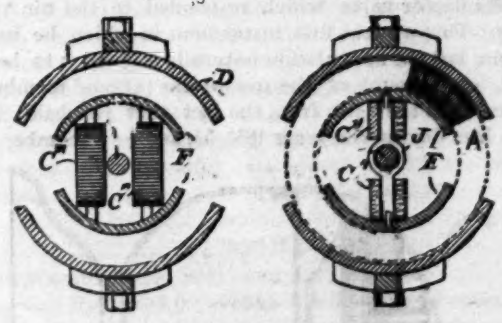


FIG. 1.—A NOVEL DYNAMO.

the inner pole-pieces by auxiliary electro-magnets. This arrangement, lately devised and patented by E. P. Clark, of Owego, N. Y., is illustrated in the accompanying engraving. The dynamo is shown in elevation in Fig. 1, and Figs. 2 and 3 show two transverse sections with different construction. As will be seen, the ring armature *A* is located between the inner and outer pole-pieces *F* and *D*, which are secured to their respective field magnets *C'* and *C*. The pole-pieces *F* and *D* are connected by plates



FIGS. 2 AND 3.—NOVEL DYNAMO.

of iron *E*. The auxiliary field-magnets are shown at *C''* and *C'''*, and their pole-pieces are those of the field-magnets *C'*. In the arrangement shown, Fig. 2, the shaft passes between the magnets *C'''*, while in Fig. 3 the shaft passes loosely through the double core of the magnets *C''*.

A New Incandescent Central Station.

The St. Louis Illuminating Company, of St. Louis, a new organization, are rapidly getting into shape to supply incandescent lighting from their central station. The station is 50 × 150 feet long, built of brick, divided into offices and storeroom, facing the street, with dynamo and engine-room adjoining and boiler-room in the rear, with ample yard facilities for coal, etc. It is built for a capacity of 3,000 lights when fully equipped, but the company commence with about half that number. They have installed a 60 horse-power Fitchburg automatic engine and use countershafting, the speed on the dynamo pulleys being 600 revolutions per minute. The system used is the Heisler. This system possesses many new features, among which is the transmission of the current over great distances on a moderate sized wire. The circuits are run with 100 lamps in series. An automatic device in the socket of each lamp cuts it out of the circuit. Should any of the lamps burn out the indicator in the station shows at the instant that a lamp has broken down. The lamp used on the Heisler system is the Bernstein. The E. M. F. is 1,600 volts, with 4 amperes. The system has been in operation for some time, a small plant being run from the Heisler Electric Light Company's works. There are many advantages in this method of arranging incandescent lamps in series, and the result of operating on a large scale is looked forward to with interest. A similar method of lighting is now in operation in Portland, Me., but only for street lighting.

The company have got their 55-foot poles in place, and are now putting up their lines, insulated wire only being used. The whole installation is being done under the supervision of Mr. Geo. H. Hewes, a prominent civil and mechanical engineer of St. Louis, who has accepted the management of the company.

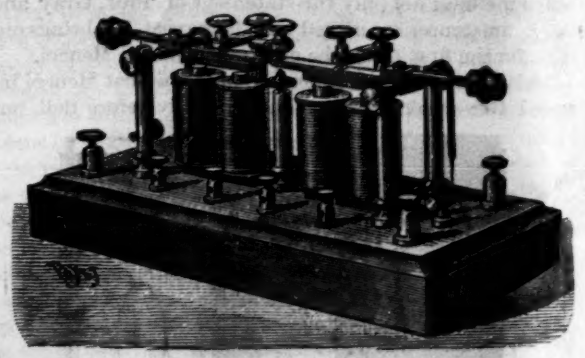
As usual where electric light stations are being started, the man is on hand who wants a light on his back stoop, and lives 60 blocks away from any of the circuits, and wonders what sort of electric light it is anyhow when he can't have a light.

The officers of the company are: W. R. Allen, President; W. R. Donaldson, Vice-President; J. W. Wallace, Secretary and Treasurer; and Geo. H. Hewes, Manager. B.

Apparatus for Individual Call Telephone Lines.

Many devices have been employed to reduce the expense of telephoning, among which the system of placing several subscribers on a single wire has received considerable attention. This method requires an individual call for each sub-station, so that no annoyance may be caused by answering calls intended for others on the line. In a system of this kind Mr. L. Maiche and Dr. D. Tommasi have recently introduced an apparatus at each station which permits the required station to be connected so that all intermediate stations are cut out. The principle consists in sending currents of different strengths from the central office, according to the office which it is desired to call, the instruments at the stations being constructed accordingly.

The apparatus shown in the accompanying engraving, taken from *Bull. Inter. d. Téléphones*, consists of two electro-magnets, each with its armature. Both of the latter are pivoted at their outer ends, and have prolongations



APPARATUS FOR INDIVIDUAL TELEPHONE CALL.

provided with springs and adjusting counter-weights.

The resistance of each armature to the attraction of its electro-magnet is such that it is attracted only when a current of a certain strength is sent over the line. In addition, the arrangement is such that if the first armature (the one to the left) alone is attracted, communication is established between the station and the central office. If, on the contrary, both armatures are attracted, the current passes on to the following stations. These connections are effected by means of a series of contacts in the centre of the apparatus. According to circumstances the armature to the left or both armatures strike against one or the other of these contacts.

Finally the apparatus at the subscribers placed on the same line, is so arranged that the action of the electro-magnet to the right, at the first station, is similar to that of the left at the second station; again the action of the right electro at the second is similar to the left at the third station, and so on.

The different instruments can be connected in series or in parallel by means of two of the four large binding-screws placed at the corners of the base. The small binding-screws receive the wires from the battery and the telephone.

The action of the system is very simple. Let us suppose that the resistances of the armatures at stations 1, 2, 3, etc., on the same line, are made to correspond respectively to currents represented by 2, 2 and 4, 4 and 6, etc., Daniell's cells. Under these conditions, if it is desired to call station 2, the current of 4 cells is sent into the line; this current overcomes the resistances of both armatures at station 1, and also the armature of the first electro-magnet of station 2. The current thus passes station 1, and stops at station 2, which is called. At the same time a signal is produced, which notifies all the other subscribers that the line is in use.

A Five Days' Telegraph Contest.

President Bates, of the Baltimore & Ohio Telegraph Company, received the following dispatch on the 20th inst. from Little Rock:

After five days' conflict between the employés of the Arkansas Telegraph Company and the Iron Mountain Railroad Company, the telegraph company have ceased work on their new line to Hot Springs, the railroad men

having pulled down the poles as fast as erected by the telegraph men. An application has been made to the Chancery Court for an injunction to prevent further interference with the work on the part of the Iron Mountain Railroad Company and other parties.

The court will probably hear the case Saturday or Monday. As the Circuit Court, under the Arkansas Telegraph law, has already ordered the telegraph company to build a line upon the railroad company's right of way, it is believed by disinterested parties that the Chancellor will sustain this right. It is supposed the action of the railroad company, in interfering with the Arkansas Company's line, is being instigated by the Western Union Telegraph Company to prevent competition.

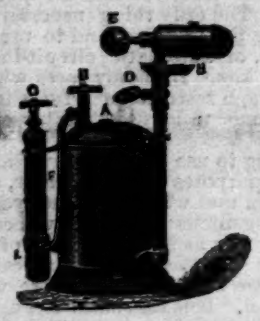
The Law as Regards Underground Wires.

In reply to Mayor Grace's request for his opinion as to whether the act of 1885, appointing a commission to place underground electric wires, repealed by implication the act of 1884, which required the wires to be buried the first day of this month, Mr. Lacombe has sent a reply in which he says: "It is in my opinion very doubtful whether the provisions of the later act (the act of 1885) regulating the course of procedure to be followed by the Commissioners in selecting a general plan of underground subways, are so inconsistent with the earlier act as to justify the conclusion that it was the intention of the Legislature to modify it in that regard.

"The statute will undoubtedly have to be construed by the courts, and as the act of 1885 expressly relieves the city authorities of the responsibility of enforcing the provisions of the act of 1884, a further discussion of the question by the Law Department would seem to be unnecessary."

Blowpipe for Soldering Electric Light Wires.

Much vexation and delay is often caused in the erection and repair of electric light lines by the premature cooling of soldering irons. To obviate this, and bring the direct flame to bear upon the joint, a handy apparatus has recently been devised by the Illinois Street Gas Company, of Chicago. It will be seen to consist of a reservoir *A*, for holding



BLOW-PIPE FOR SOLDERING ELECTRIC LIGHT WIRES.

gasoline, a force-pump *C*, and a burner *E*. A few strokes of the pump create and maintain a pressure on the gasoline and force it out of the burner in a fine spray, which generates an exceedingly hot flame, that can be regulated to any size. The apparatus is made in very portable form, and is said to be highly efficient. We know of its use with excellent results by various electric light companies and others.

More Nightly Sunshine for Sunbury.

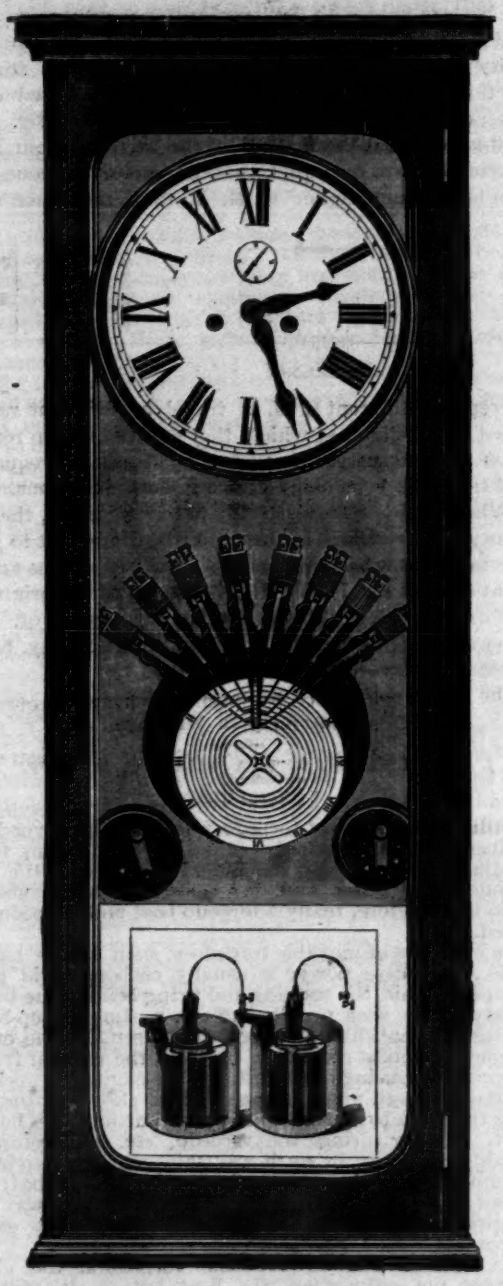
The Edison Electric Light Company, of Sunbury, Pa., are now building a new central station of increased capacity and in a more desirable location. The new station is a brick and stone building with slated roof. The engine and dynamo room is 36 × 50 feet and boiler room 22 × 24 feet.

They have purchased in addition to their present plant a 13 × 14 inch Armington & Sims engine and two Keeler boilers of 80 H. P. each. The dynamo capacity is also increased about 1,000 lights. Mr. Geo. Heim, the superintendent of the company, states that they expect to light up in their new quarters on or before Jan. 1. Extra feeders and mains are now being put up. This looks encouraging for central station lighting, as the company have had a trial of nearly two years with their old plant.

An Electric Watch-Clock.

Boston, like New York and some other cities, is protected against the operations of thieves and burglars by the ever ready electric current. The Boston Electric Protective Association has many business houses, theatres, etc., connected with its central office, and the patrol in connection therewith has in more than one instance prevented loss from a number of causes. The same association has recently introduced a watchman's electric register, which is designed to remove some of the defects heretofore existing in some forms of this apparatus. As is well known, some forms of watchman's registers employ a dial moved uniformly by clock work, and upon which marks are made at various stations provided with keys.

The clock, which is shown in the accompanying engraving, is the invention of Mr. G. W. Adams, and has for one of its objects the detection of any attempt on the part of the watchman to evade duty by closing the circuit of any of the recording instruments at any other point except where its key is located. For this purpose each key is placed in circuit with a tell-tale wire, and the tell-wires from all the keys pass through a single tell-tale recording instrument common to all the stations. The circuits are normally open branches, passing from one pole of the common battery through the actuating magnet of each recording instrument, and thence to the corresponding key. In addition, one wire passes from the same pole of the battery through the tell-tale recorder, and thence to all the keys, at each of which the tell-tale wire is connected to the back-stop or contact-point of the key. In this way the tell-tale wire and station circuit wire are normally connected, but when the key is depressed, the wires are disconnected. A battery-wire passes from the other pole of the battery to the anvil-piece of each key, so that by depressing the key the circuit is closed therefrom and the battery thrown upon the corresponding recording-instrument, which is thus caused to make its record. If, however, the circuit is closed otherwise than by depressing the key—as by throwing a battery-wire on at any other point—the current will



AN ELECTRIC WATCH-CLOCK.

divide, a portion passing directly through the corresponding station recording-instrument and a portion passing from the key to the tell-tale wire and recorder, so that a simultaneous record will be made by the tell-tale instrument and by the instrument of the station which the watchman sought to evade visiting without detection.

The clock-case containing the recording-dial is provided with a circuit-closer, operated by opening the case, and controlling a recorder, so that if the watchman should attempt to make his record by opening the clock-case, that fact would also be recorded. The clock-case recorder is also operated when the recording-dial is removed and a new one inserted, so that a record of the time of the operation is made.

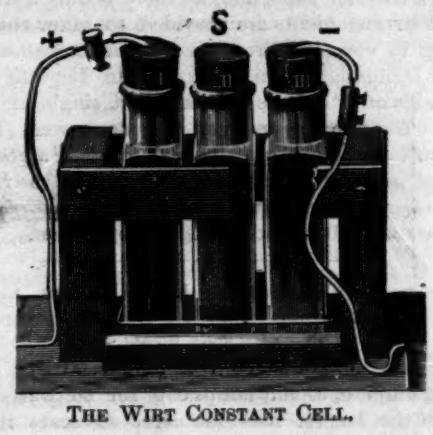
The recording-instrument consists of a sharp-pointed finger at the end of an arm connected with the armature of an electro-magnet, which is arranged to operate as an automatic circuit-breaker, so that the pointed finger is vibrated rapidly, thus insuring a certain and distinct record upon the paper passing beneath it.

The Magnetic Survey of Scotland.

Professors Thorpe and Rücker have, during the past two years, been engaged on a magnetic survey of Scotland. Their observations were made at fifty stations distributed throughout the country, and chosen partly with a view of repeating the measurements made by Mr. Welsh, of the Kew Observatory, in 1857–8, and partly of avoiding, as far as might be, regions of great local disturbance. They employed magnetometers and dip circles of the most approved modern type, and specially made for the survey. These were compared with the standard instruments at Kew, which thereby becomes the base station of the survey. In the determinations of solar azimuths in the observations for declination, they were enabled to compare their chronometers with time signals sent from the Greenwich Observatory daily at 10 A. M. and 1 P. M. o'clock over the Postal Telegraph wires. The special observations were also made in the Island of Mull, which, from its geological nature, exercises very powerful disturbing effects on the magnetic needle. The results of the survey show that such disturbing areas may be approached within certain distances without the compass being affected. While upon this subject, we may mention that Herr J. Liznar has communicated a paper to the Austrian Meteorological Society, in which he shows from a great variety of observations, that the moon exerts an influence on the declination needle, which varies with the distance of that body from the earth, with its phases, and positions in reference to the earth's equator. Herr Liznar finds that the magnetic perturbations are greater when the moon is nearer the earth, and greater when it is full moon than in the first and second quarters. The perturbations are also a maximum when the moon is in the plane of the equator, and larger when her declination is austral than when it is boreal.

The Wirt Constant Cell.

This battery is a modification of the well-known Daniell battery. It is so constructed that the fluids cannot become disturbed or mixed through any slight jarring. It consists of three square bottles, 1¼ square inches by 4¼ inches high, with a neck ⅜ of an inch in diameter by 1 inch long, securely clamped together at the top and bottom, as shown in the engraving. In the upper part of the adjoining sides of bottles I. and II. is drilled a small hole ⅜ of an inch in diameter, and in the lower part of the adjoining sides of bottles II. and III. are similar holes, all arranged to correspond with each other.



THE WIRT CONSTANT CELL.

A soft rubber washer separates the bottles at the holes making a water-tight joint, and also acting as a support to hold in place a thin film of gold-beater's skin, through which the liquids must pass by the process of endosmose and exosmose, from one bottle to the other.

All of the bottles are filled with a dilute solution of sulphate of zinc; within bottle I. is placed a piece of sulphate of copper about the size of a pea, which changes the solution to a blue color; the copper electrode at the bottom is connected by an insulated wire, which passes through the cork. At the bottom of bottle II. is a small piece of zinc which collects any deposit of sulphate, should any pass through from bottle I.

In the top of bottle III. is suspended the zinc electrode, which measures about 1⅛ inches long by ⅝ wide and ⅛ thick.

It will be seen that this arrangement gives a very constant battery which cannot polarize, as each electrode is completely isolated, and the separation of the bottles with the gold-beater's skin also prevents an easy mixture of the solutions.

The Postal Telegraph Again.

Senator Edmunds, it is believed, will not be satisfied when Congress meets by a mere introduction and reference to the proper committee of his bill providing for the establishment of a postal telegraph, but will push the bill to consideration, and, if possible, to a vote. Senator Edmunds' idea is to create a board, consisting of the Secretary of State, the Secretary of War, and the Postmaster-General, whose duty it shall be to lay out four trunk lines connecting the northeastern, the northwestern, the western and southwestern, and the southern parts of the United States with the city of Washington. Along these trunk lines connections are to be made and telegraph offices established according to the demands of the service. The postal telegraph is to form part of the postal system, and the rates are to be fixed from time to time by the Board already mentioned. The lines are to be constructed and kept in repair under the direction and superintendence of the Secretary of War and through the Corps of Engineers. The Secretary of War is to be authorized to acquire by purchase, subject to the approval of the President, the right of way for the construction of the lines and their extensions. Damages,

if disputed, are to be referred to the Court of Claims for assessment, with appeal to the Supreme Court. The government is also to be authorized to acquire by purchase the stock, machinery, appliances and materials, not including telegraph lines, owned by persons or corporations, which shall be deemed necessary for the operation of the government lines. In case of a dispute as to the value of such property, the Court of Claims is to arbitrate on the question. Employés in the postal telegraph service are to be appointed according to the provisions of the Civil Service act. Nothing, according to Mr. Edmunds' plan, done by the government in the matter, is to interfere with or prohibit individuals or corporations from carrying on the business of operating telegraph lines.

T. M. B. A.

The annual meeting of the Telegraphers' Mutual Benefit Association was held on the 19th inst. at 195 Broadway. The balance sheet as given in our last issue was presented and accepted. The following officers were elected for the ensuing year:

President, A. R. Brewer; Vice-President, W. H. Young; Secretary, Charles P. Bruch; Treasurer, E. T. Mackay. Executive Committee: A. R. Brewer, New York; W. H. Baker, New York; J. Merrihew, New York; C. W. Hammond, St. Louis; Joseph Uhrig, Chicago; W. H. Young, Washington; Joseph L. Edwards, New York; Charles P. Bruch, New York; W. B. Gill, Philadelphia. Auditing Committee: S. S. Garwood (Chairman), Philadelphia; M. J. O'Leary, New York; W. J. Dealy, New York.

Mr. Uhrig, of Chicago, proposed that the meeting next year be held in Chicago. The idea met with favor, and is now under consideration by the officers.

Electric Railway at South Bend, Ind.

Last week saw the opening of an electric street railway in South Bend, Ind., built on the Van Depoele system. The current is led to the cars by an over-head wire upon which a traveler runs, and, as there is only a single wire, special arrangements are provided to allow the travelers moving in opposite directions to pass one another. The energy is obtained from two large Van Depoele dynamos, both fields of which are excited by a single exciting dynamo. The machines are run by water power. The tracks constitute the return circuit, and to make a good circuit, strips of brass are laid under the joints of the rails. The speed of car is under full control by means of switches, and the road will soon be in regular operation.

A Question for Lamp Makers.

To the Editor of The Electrical World:

SIR: If 8 ampère, 100 volt lamps call for 80 watts, and 1.2 ampère, 50 volt lamps call for 60 watts, why do some of the largest manufacturers advocate the higher potential lamp in isolated plants, where the cost of wiring is not materially different? E. T.

LYNN, Mass.

ANSWER.—If your latter statement is correct we can only say: "Read the answer in the stars."—EDS. E. W.

Details of Domestic Motor.

To the Editor of The Electrical World:

SIR: The details given by F. H. in Vol. VI., No. 14, of THE ELECTRICAL WORLD, for the construction of domestic motor, do not convey any idea of the size of wheel. Will you please publish diameter of wheel, also if brass or iron and if solid or not. J. V. ARRISON.

TRENTON, N. J.

ANSWER.—The metal of the wheel is immaterial. Iron would be cheaper than brass. The scale accompanying the drawing will give you the dimensions.—EDS. E. W.

The Employment of Condensers in Telephoning.

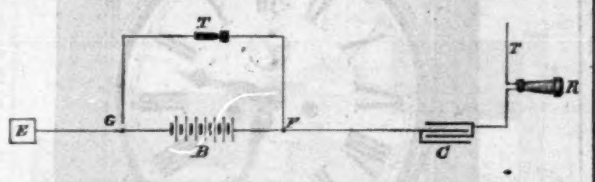
BY D. H. F.

In an article under the above heading in THE ELECTRICAL WORLD of Nov. 7, credit is given to MM. Baudet and Herz, of France, for a method or system of transmitting through condensers, which I think may properly be claimed for this country. Early in 1879 the writer made and used a system every way identical with that shown in the diagram, with the exception of "sheet *C*," the utility of which may be doubted. By reference to the following, which is copied from my original diagram, it will be seen that the arrangement and connections are the same; the only difference being in the construction of the diagram.

This system, under the name of "a battery transmitter by static induction for condenser method of working speaking telephones," was described to the then National Bell Telephone Co., in letters dated on and subsequent to March 20, 1879, and is the subject of U. S. patent No. 249,605, filed April 24, 1879, issued November 15, 1881. It may be called a method of transmitting by rise and fall of tension. In order to show that the essentials named in the article referred to were clearly seen, I quote from early descriptions.

"*L*, represents the line; *R*, magnetic telephone; *C*, condenser; *B*, battery; *T*, transmitter or microphone; *E*, earth; *F*, *G*, points of contact of wires leading to the transmitter. If the circuit is broken at *T*, the condenser will be charged to the full tension of the battery, and a momentary current of the same tension, equal to the capacity of the condenser, will be induced upon the line If the circuit be closed at *T* with *no* resistance, the tension at the point *F* will fall to that at *G*, the condenser will be discharged through the route *F*, *T*, *G*, and a momentary current equal in all respects to the first will be induced in the opposite direction, on the line. If the resistance at *T* be varied between these extremes, the charge in the condenser will vary accordingly in proportion to the resistance, and corresponding reciprocating currents will be induced upon the line." It is well known that exactly the same length of time is required to discharge a condenser that it takes to charge it; hence the current induced by the discharge is equal in all respects to the one induced in charging it. The advantage of this equality, in transmitting long distances, needs no argument.

It was evident, that to make the tension sensitive to slight variations in the resistance at *T*, the battery should have considerable internal resistance. In the letter above referred to, the following words were used: "The cells of the battery used with this transmitter may be very small, and should have great internal resistance." The practicability and desirability of transmitting currents from induction coils, through condensers, was pointed out in letters dated on and subsequent to March 31, 1879. It is well-known that the E. M. F. of the currents from an induction coil are not equal, that the current in one direction has a much higher E. M. F. than the other, and as



currents of different E. M. F. travel at different rates of speed, the distance at which they confuse is soon reached. Such currents, passed through a condenser, are equalized, and the E. M. F. made the same in both directions.

Whether this system has any practical merit, there are plenty of electricians in this country competent to judge. The fact that it has not been put into use may be an argument against it. It has at least the merit of originality, and dates long prior to any I have been advised of. Until older dates can be established, the credit, if any, belongs to this country—not to France.

Electricity in Warfare.*

BY LIEUTENANT B. A FISKE, U. S. NAVY.

(CONCLUDED.)

Still another class of torpedoes are movable torpedoes. These contain not only explosives and means for exploding them, but also machinery for moving the whole through the water and for steering. A movable torpedo is, therefore, really a torpedo boat and torpedo combined.

In one class of movable torpedoes, such as the Lay torpedo, the motive power is usually carbonic acid gas or compressed air, the steering and firing being done by electricity. One wire usually suffices, a simple step-by-step device accomplishing the operation of sending the current through different circuits in the boat, the current through one circuit causing the throttle of the engine to open, the current through another causing it to close, another putting the helm to starboard, another putting the helm to port, another firing the torpedo, etc. Therefore, the operator on shore, or on board ship can, by moving his switch in the proper manner, cause the torpedo boat to go ahead, stop, turn to the right or left in such a way as to go directly toward the object of attack, and then explode in contact with her bottom.

In another class of movable torpedoes, the electric current not only steers the boat, but it also propels it, there being an electric motor or engine inside, which when supplied with the requisite current from an electric machine on shore or on shipboard, revolves rapidly, thereby causing the propeller of the boat to revolve, in the same way that a steam engine causes the propeller of a steamboat to revolve. The current for steering may either be sent along a separate wire which may be inside the other one, or a device may be used by which one wire will suffice for everything.

Movable torpedoes being usually cigar shaped, so that their section is circular or nearly so, the electro-motor for an electric movable torpedo which will most nearly fit the space intended for it, in other words the shape which permits the largest size for a given space, is clearly one in which the distance from the centre of the armature to the outside of the magnets is constant, so that the field magnets form nearly a circle embracing the armature. The exterior form of the motor called the Griscom motor evidently seems to fulfill this condition well.

The most successful movable torpedo thus far tried is the Sims torpedo, with which experiments have been conducted under Gen. Abbot's superintendence for some time and with very good results. Now as all men of war and all forts are to be supplied with means for generating electricity on a large scale, it is clear that an electric movable torpedo can be easily adapted to naval and military requirements, the mechanism of the torpedo being exceedingly simple, the only thing to be done to put it into operation being to connect it to a suitable electric machine, and introduce a key-board by which the direction and strength of the current can be controlled. The torpedo will then be ready to move at any instant, and will have a supply of power practically inexhaustible.

Recent experiments in England have shown that the Whitehead torpedo, over which control ceases after it is fired, is not so formidable a weapon when fired at a ship under way, as many supposed, for the simple reason that it can be dodged. Now an electrical torpedo, over which control is exercised while it is in motion through the water, cannot be dodged, provided it be given sufficient speed.

For effective work against ships capable of steaming fifteen knots per hour, the torpedo should have a speed of twenty knots. Now there is no theoretical difficulty in the way of doing this, for a speed of 11 knots has already been recorded, though an electric torpedo to get this speed would have to be larger than a Whitehead having the same speed; and it may be conceived that a torpedo carrying, say 50 pounds of gun-cotton, capable of going 20 knots per hour, so that it would pass over a distance of 500 yards in about 45 seconds and yet be absolutely under control all the time, so that it can be constantly kept pointed at its target, would be a very unpleasant thing for an enemy to meet.

Our civil war introduced another use of electricity into warfare, and gave birth to the art of military telegraphy. At first the telegraph was used only in communicating along the regular telegraph routes, but eventually a corps of Military Telegraphers was formed, and instant communication became possible between detachments in the field. The advantages of the telegraph in conveying information and orders with dispatch was found to be so great that foreign nations took the hint, and to-day a telegraph train is essential to all armies. No well equipped force in the world is without means for rapidly connecting by telegraph different headquarters with each other and with the different parts of an army, and in the Franco-Prussian war it was the telegraph combined with the railroad which made possible that wonderful speed and certainty of mobilization and manœuvre that caused the swift destruction of the armies of France.

In military telegraph trains, miles of wire are carried on reels in specially constructed wagons, which carry also batteries and instruments, some of the wire being insulated, so that it can rest on the ground, and thus be laid out with great speed, while other wire is bare and is intended to be put on poles, trees, etc. For mountain service the wires and implements are carried by pack animals. Regularly trained men are employed, and they are drilled in quickly running lines, setting up temporary stations, etc. In the recent English operations in Egypt the advance guard always kept in telegraphic communication with headquarters and with England, and after the battle of Tel-el-Kebir, news of the victory was telegraphed to the Queen and her answer received in 45 minutes.

The telephone has also been used in military operations and with great success; having an evident superiority over the telegraph for some purposes. One use of the telephone, in fact, is to assist the telegraph in cases where, by reason of the haste with which a line has been run, the current leaks off, so that the receiving instrument will not work. The only thing necessary is to use a telephone to receive the message, and to use as a transmitter a simple buzzer, or automatic circuit-breaker, controlled by an ordinary key. In many cases where the ordinary receiving telegraph instrument refuses to work, the more delicate telephone thus used will work very satisfactorily.

In endeavoring to use the telegraph and telephone for strictly naval purposes between ships, a number of obstacles have been met which have not yet been overcome, though many ingenious devices have been attempted. It might seem at first as if, in the case of ships at anchor, telegraphic and telephonic communication among the ships and between the ships and shore would be an easy thing to establish. It is easy, and it has been established in the case of ships moored so that they cannot swing; but when a ship swings by a long chain, most of which is embedded in the mud, it becomes very difficult to devise an automatic means to keep the wire from being fouled and broken. In England, in the case of a lightship the difficulty has been surmounted or rather avoided by making the cable by which the ship rides hollow, and running an insulated wire along the long tube thus formed inside. This plan has been found thus far to work very well, even in the worst sort of weather.

But the problem is much simplified when temporary communication only is desired between ships at anchor, between a ship and the shore, or between a ship and a boat which has been sent off on some special service, such as reconnoitring, sounding etc. In this case portable telephones are used, in which the wire is so placed on a reel in circuit with the telephone, that communication is preserved, even while the wire is running off the wheel.

The telephone has been used to some extent on shipboard for communicating between different parts of the same ship, giving orders to the magazines, battery, etc. The vibration of a ship is seldom so excessive as to impair the working of the microphone transmitter; and in cases where it is excessive, the original magnet-transmitter has been found to work perfectly, getting rid entirely of trouble due to vibration, and at a cost of only little of the loudness of tone as heard in the receiver.

The telegraph and telephone are both coming largely into use in artillery experiments and drills, as in tracking a vessel as she comes up a channel so that her exact position at each instant is known, for determining the spot of fall of a projectile, etc. In these cases, two observers at the ends of a base line electrically connected know at each instant the bearing of the vessel or the projectile from both ends of the base line, and the intersection of these lines of bearing is, of course, the position of the vessel or the projectile at that instant. In the case of a vessel, this gives the range for the guns, and in the case of a projectile, it shows how much the projectile missed the target. In getting the time of flight, also, of projectiles, electricity is of value, since it enables the observers to get the exact time of start—a thing impossible to get with stop watches; but by making the projectile break a wire in circuit with a chronograph, the precise instant of start, to a thousandth of a second at least, is automatically registered.

An application of electricity somewhat analogous to this has been in use for years in what are broadly called velocimeters, that is, instruments for ascertaining the velocity of projectiles. There are scores of patterns, but in all wires are cut by the projectile at different points of its flight, and the breaking of each wire causes the breaking of the electric current going through it, and this causes the appearance of marks on a surface moving along at a known speed.

Now, knowing the rate at which this surface moves, and observing the distance on the surface between the marks caused by the breaking of the first wire and the marks caused by the breaking of the second wire, we can compute the interval of time which elapsed between the

* Lecture delivered before the Franklin Institute, Nov. 13, 1885.

breaking of the two wires, and now, knowing this interval of time, and knowing also the distance between the two wires, we can calculate at once the velocity of the projectile in going from one wire to the other.

Within the past few years electricity has come to be employed to a great and increasing extent in firing great guns both in ships and in forts.

In the case of ships, the advantage of electrical firing lies in the fact that a gun can be fired more quickly by electricity than by other means. The ordinary means of firing are, as is well known, percussion and friction, and in each of these systems the moving parts have to be of such strength that considerable force must be exerted by the arm in order to operate them. Moreover, for prudential reasons, the line leading to them from the hand must be kept very slack, lest a lurch of the ship should cause such a movement of the man's body as to bring a strain on the line sufficient to cause the accidental firing of a gun. Therefore, when the gun captain finds the sights on the gun bear on the target, he mu-t then move his arm through a considerable distance and exert considerable force before the gun will be fired. It may seem as if the time were insignificant, but when it is considered how rapidly a ship rolls, how swiftly a modern ship moves, and when it is remembered how small an error in elevation suffices to make a projectile fall short of or go over a ship which subtends a very small angle in a vertical plane, it will be seen that a fire which comes instantaneously with the coincidence of sights and target, is better than one which does not. Now, in firing by electricity the gun captain holds a sort of push-button in his hand, which he simply presses when the sights bear on the target; and practical experiments abroad have shown that greater accuracy is attainable by this method than is attainable by the old methods. But not only are modern vessels of war fitted with means for electrically firing individual guns; they are also fitted with means for firing any desired number together, the whole broadside even; for the effect upon an enemy of a blow from a whole broadside at once is very much greater than the effect of the same number of guns delivered at different times.

The simplest way of doing this is to lead the electrical wires from all the guns to an armored fighting tower, where a cool officer, under the personal direction of the commander, with an electrical key-board and a good system of sights, can deliver the whole fire of the broadside at once upon an enemy.

This officer, being clear of the smoke and away from the excitement and bustle of the battery, and with a view of the whole horizon, can clearly handle the battery with its maximum effectiveness; and, moreover, as soon as the guns have been laid at the range and in the direction at which it is intended to fire them, the men can lie down and be protected in a measure from the murderous fire of machine guns. Suppose that two modern ships are about to engage in a naval duel on the high seas, and that they are advancing toward each other at a speed of 14 knots an hour each, so that they are coming together at a rate of about 46 feet per second. The ships will of course begin to play on each other with their machine guns as soon as they get within range, so that as soon as the great guns are ready, the men had best be made to lie down on the deck in rear of them.

Now the battery of each ship will probably be composed of guns firing projectiles of from 100 to 1,000 lbs., and each commander knowing how much damage can be done by one well delivered shot, knowing how long it takes to reload a modern gun, and appreciating the great speed at which the ships are approaching, will probably reserve his fire until sure that he has a good chance of making every shot tell. He will hardly fire at 2,000 yards range, knowing that his chance of hitting the rapidly moving target is small, and knowing that it will be only about one minute before the enemy will be at 1,000 yards range. Now, at 1,000 yards range the machine guns of both ships will be working vigorously and each ship will have an excellent target, but a target improving so rapidly that a commander would not wish to throw away all the shot of his great guns until a closer range is reached. One gun, for instance, might be fired now, having been previously laid for this range, of course; but probably it would be best to reserve nearly the whole broadside to be delivered simultaneously as the ships rush by each other at pretty close range. With the heavy guns and carriages of the present day it would be impracticable to keep a gun pointing at a ship under the circumstances, since both range and bearing are changing so rapidly, therefore the gun must be pointed in certain directions and laid for certain ranges, and fired when the enemy reaches the spots thus defined.

In the case of a fort, the value of firing by electricity is evident, since it can be employed in connection with the instruments used for determining at each instant the position of an approaching vessel or army. Different guns being laid at different ranges and in different directions, an officer in the operating rooms can keep track of the exact position of the enemy, and when the enemy reaches one of the predetermined points, all he has to do is to touch an electric key and fire the guns, or a gun controlled by that key, knowing that those guns are not only pointed in the proper direction, but also are elevated for the correct range. It would seem difficult to improve upon the accuracy attainable by this method.

Whitehead torpedoes also are so arranged that they can be ejected by pressing an electric button; and the firing key-board in the fighting tower of a ship indicates at any instant what guns and torpedoes are ready for firing. The fighting tower should also be fitted with engine and steering telegraphs, and indicators for showing whether the commander's orders to the engine and steering apparatus have been understood and executed, so that the commander can tell at a glance the exact state of affairs at battery, engine and steering apparatus, and can have all the separate departments of his ship under absolute personal control.

Within the past three years the superiority of the incandescent electric light over all other lights for ship use has become more and more evident; and now nearly all first-class merchant steamships launched, and all men-of-war, are fitted with electric lights. In men-of-war, this light has even more advantages than in merchant ships, by reason of its safety in illuminating magazines, shell rooms, torpedoes, store rooms, etc., and the ease and speed with which it can be used in signaling at night.

For some time the electric light was declared unsuitable for naval use, the reason being urged that if the wire carrying the current should be shot away in action, the whole ship would be plunged into darkness, and that the same thing would happen if any accident should befall the dynamo generating the current. The answer to this very sensible criticism is that, 1st, different circuits must be arranged for different parts of the ship, so that an accident in any part of the ship will affect that part only; 2d, that the wires carrying the current must be arranged in duplicate, so that even in case one wire is shot away the light will burn as brightly as ever, since the other wire remains, and is of sufficient size to carry all the current; 3d, it is very easy to repair a break in a copper wire, even if it be shot away, the only thing necessary being to bridge over the break by a wire a few inches long, whose ends can be clamped, spliced or even twisted on to the broken conductor on each side of the break. As to the danger to be feared from accident to the dynamo and engine, this can be guarded against in two ways: 1. By placing the dynamos and engines in a place as well protected as that occupied by the main boilers and engines of the ship, preferably near the engines, below the water line and under a protective deck, and this place should be provided in laying down the original plans of the ship. 2. By not placing dependence on one dynamo and engine alone, but by dividing the total work among three or four, so that in case of accident to one the ship will have the benefit of all the others. To this end all the dynamos should, of course, be of the same electromotive force, and feed into the same mains from which all lamps draw their supply, and which are fed by feeders from the dynamos at different points, so that accident to the mains in one part of the ship will affect that part of the ship only. But it is the arc light, used as what is called a search light, that is most valuable in warfare, a search light being simply a very powerful arc light so arranged with a catadioptric mirror that it throws out a very concentrated beam of light, and so mounted that this light can be cast in any desired direction and made to illuminate any locality which it is desired to inspect. I believe the first use made of search lights was in the siege of Paris in the Franco-Prussian war, when the French employed them to discover the operations of the besieging army at night. Their value from a military point of view was so evident that other nations took the hint and introduced them into their military and naval services. Since then their use has been extending, more probably for ship use than for use on shore, though they are employed considerably also in forts guarding the approach to harbors to watch for the approach of hostile fleets, torpedo boats or countermining expeditions at night.

For the use of an army in the field, search lights are mounted on suitable wagons, together with portable boilers and engines, so that they can be taken on the march, moved to any part of the field, the top of a hill for instance, and employed at night whenever desired. It is clear that a search-light might often be very useful in doing such work as searching for wounded after a battle, examining the nature of the ground in a comparatively unknown country, watching the enemy when a surprise might be anticipated, guarding against a sortie from a beleagued fort or city, etc.; on many occasions, in fact, when the darkness of the night might be a hindrance to the operations of an army or an element of insecurity.

On board men-of-war the principal use of the search light has been in watching for the attack of torpedo boats; but the experments in Bantry bay last July showed that it was often useful in detecting the approach of hostile ships, in aiding the sighting of guns at night by bringing the target out clearly, and in embarrassing the operations of a torpedo boat or ship in trying to force a passage up a channel by dazzling the eyes of the enemy one instant and leaving them in total darkness the next.

It was related that in Africa some three years ago an attack on a fort was frustrated by a single search light. The barbarians advanced to the assault brave and determined under cover of darkness, but were suddenly terrified by finding themselves enveloped in an awful and miraculous light which turned night into day. Halting for an instant, they covered their eyes to shield them from its dazzling whiteness, then suddenly turned and fled in panic.

But, even had they not been barbarians, even had they been trained soldiers of a highly civilized people, how bewildered they would have been to find themselves suddenly in such a brilliant light that their eyes were blinded so that they could not see to pick their way; and then in a few seconds, just as the pupils of their eyes had contracted under the influence of the light, to find themselves suddenly in total darkness. Such alternations of dazzling light and black darkness would render the march of an attacking force over a broken country toward a fort a very difficult undertaking; for it should not be forgotten how dependent we are upon our eyes for our most simple actions and how much our eyes assist us even in the dark. It may be pointed out here, that the search light, like all other military instruments, must be used with judgment. It should not be used for instance when it is important to keep your position secret from the enemy, unless the advantages of observing him outweigh the disadvantage of disclosing your own position; or unless you can immediately extinguish your light, and change your position. In order to use the search light effectively on board ship, there should be four on each side of a ship. Search lamps are of much higher power than any other lamps that have ever been made, and the effect of the white cylinder of light, as it touches up the different points of the land or sea over which it is made to rapidly pass, is striking and beautiful in the extreme. The people of Philadelphia may remember the naval search light with which I used to illuminate the city last autumn, and do not have to be assured of its power and beauty. The best idea that I got of its illuminating effect was got one night when I went to the tower of the Penna. R. R. depot, and watched the light stationed at the electrical exhibition building on Thirty-second street. The ray of light when turned at right angles to my direction looked like a silver arrow going through the sky; and when it was turned on me, I could read the fine print of a R. R. time table at arm's length.

For signaling at night incandescent lights and search lights both have been used, the search lights being employed to reach long distances or to reach points hidden by hills or other intervening objects. In using the search light in this case the beam is thrown into the sky, and signals are made by showing long and short flashes, or by interrupting the beam in accordance with any preconcerted code. Flashes from the search light which I had at the electrical exhibition last autumn were seen from a distance of thirty miles.

In using incandescent lamps for night signaling, the simplest way is to arrange a keyboard with keys marked with certain numbers indicating the numbers of lamps arranged in a prominent position, which will burn while that key is being pressed. If it be desired to signal the number 5348, for instance, meaning, let us suppose, "Prepare to receive a torpedo attack," it is only necessary to press in succession keys marked 5, 3, 4 and 8, and the light of 5, 3, 4 and 8 lamps will successively blaze out and expire.

Other codes, of course, can be used; the Morse code, for instance, in which a dash can be denoted by two lamps and a dot by one. One lamp could, of course, be used; the dot being denoted by a short flash and a dash by a long flash, but it is found best practically not to use time intervals in optical telegraphy.

Electric lights have been used considerably of late in photographing the bores of great guns. Views can be thus obtained of any part of the bore, showing whether the gun has been accurately bored and rifled and showing how the metal is standing the erosion of the powder gases.

One of the needs arising in modern warface is means for handling heavy ordnance with speed and precision and for bringing up ammunition. Guns, carriages and ammunition have increased so much in weight, that it has become more difficult to handle them quickly than it used to be, and yet the speed of ships has so increased that there is more necessity for handling them quickly. The electric motor will certainly be used for handling ordnance on board ships not very heavily plated with armor, for it is clear that a small wire is a much more convenient way of conveying energy to a motor of any kind, and is much less liable to injury in action than a comparatively large pipe for conveying steam, compressed air or water under pressure; and, besides the electric motor is the ideal engine for work on board ship by reason of its smooth and silent motion, its freedom from dirt and grease, the readiness with which it can be started, stopped and reversed, and its high efficiency.

In forts, Colonel Hamilton, U. S. A., says that heavy guns must be worked by dynamo-electric machinery, since some other power than manual power must be employed, and since electricity is better than steam, compressed air or water under pressure, because it can be conveyed from a central source by a single wire. Now, in forts, it is clear that the dynamos for search lights, and incandescent lights, and for generating power for the electric motors for handling the guns could be placed in a well protected spot, and the wires leading therefrom could pass to the guns through underground pipes where they would be well protected from projectiles, and the guns could be pointed in any desired direction with speed, silence and precision by the simple turning of a lever or the moving of a switch.

It is probable that in the near future every man of war and every fort will be fitted with a complete "electrical system," well protected from projectiles, which will include dynamos capable of supplying a very large amount of electrical energy to a system of mains, from which all the incandescent lights, all the search lights, and all the motors of different sorts can draw the supply of energy requisite for their needs.

Electrical launches have been tried abroad to some extent, and with results which, though not completely satisfactory, give promise of success in the future. These boats are propelled in the same way as other boats, that is, by a propeller revolved by an engine, except that the engine is an electrical instead of a steam engine. The electrical engine draws its power from what are called storage batteries carried in the boat. These storage batteries are first charged by a dynamo ashore or on board ship and then are capable of rendering up to the motor the electrical energy stored in them, so that the motor is made to revolve and thus cause the revolution of the propeller and the advance of the boat through the water. These electrical launches have carried hundreds of people and have made a speed of about eight knots per hour, and the electric engine has worked perfectly well, but there has been considerable trouble with the storage batteries. Now, these storage batteries are improving every day, and as their defects do not now seem irremediable, and as a great number of electricians are devoting study and experiment to them, we may hope that storage batteries will soon be efficient and durable. This done, the electrical launch will certainly replace the steam launch in warfare, by reason of the quickness with which an electric launch can be got ready, as there are no fires to be lighted, and, above all, by reason of the noiselessness of the electric motor, and of the fact that in an electrical launch no flame ever flares up above a smoke pipe. With steam torpedo boats this flame frequently betrays them; that is, if the noise of the exhaust has not already done so. In using electrical launches in warfare, two sets of storage batteries will of course be necessary, so that one set can be replaced by another, and used while the first set is being re-charged.

A novel application of electricity has recently been made in what have been named "electric sights." It is well known that it is difficult to get a sight at an object in the dark, first because the object itself cannot be distinctly seen, and second because the front sight of the gun cannot be distinctly seen. Now Mr. Gaston Trouvé has recently invented an electric sight no larger than the ordinary front sight of a musket, which consists simply of a filament of fine wire in a glass tube covered with metal on all sides save at the back. It looks much like an ordinary sight except to a man looking along the barrel towards the back of the lamp. But the battery man so looking, sees a fine incandescendent wire. The battery is said to be no larger than a man's finger, and to be attached to the barrel near the muzzle by simple rubber bands, so arranged that the act of attaching the battery to the barrel automatically makes connection with the sight; and so arranged also that the liquid of the battery is out of action except when the musket is brought into a horizontal position for firing.

To throw a good light upon the target, the same inventor has devised a small electric lamp and projector, which is placed on the barrel near the muzzle by rubber bands, the battery being held at the belt of the marksman with such connections that the act of pressing the butt of the musket against the shoulder completes the electric circuit and causes a bright cylinder of light to fall on the target, thus bringing it out into strong relief and enabling the marksman to get as good a shot as in the daytime.

An application of electricity coming somewhat into use abroad in Continental armies is in connection with ballooning, which has received there the benefit of considerable attention and experiment. It is well known to all here that balloons have been much used for observing the movements of the enemy from a distance, and now it is reported that not only have balloons been successfully fitted with telephones for communicating at once to people on the ground the nature of the information gathered, but

also with small search lights by which the ground can be illuminated for a considerable distance at night and the enemies' maneuvers discovered.

Incandescent lamps have also been sent up in small translucent captive balloons and under small ordinary captive balloons, and signals have been transmitted to a distance by making and breaking the current according to a preconcerted code.

Yet another way in which electricity will undoubtedly be used in any future war between civilized powers is in submarine boats which go beneath the surface of the water, to attack ships below the water line. Though it cannot be said that submarine boats have ever yet been successful, still submarine boats are being improved, and men have always been found willing to risk their lives in them. Some have been devised of late years in which the propelling power is electricity derived from storage batteries. In submarine diving, the telephone has been used with success in maintaining constant communication between the diver and his attendants above water, and the incandescent lamp suitably protected has also been lowered into the water to light him at his work. Submarine diving will certainly play a part in future wars, the diver descending to cut an enemy's torpedo-cables, or to inspect or repair damages to submarine wires or to ships. Progress is now beginning in what have been christened "electrical guns" in which the cartridge contains an electric fuse which is ignited by pressing an electric push button on the gun, instead of containing the ordinary percussion primer, which is struck by a hammer or bolt when the trigger is pulled. At present this invention has not reached the practical stage, and the necessity for a battery to fire the cartridge is decidedly an objection. Yet we should remember that the battery required is very small, that it needs very little care, and that it will last a long time. We should also note that an electric gun possesses the great advantage that a better aim can be got with it than with one fired by a trigger, for the reason that the hard pull of the trigger causes a movement of the barrel, except in the hands of the most highly skilled marksman. Now this hard pull of a trigger is a necessity, since the hammer or bolt must have considerable mass, in order that it may be strong enough to strike the primer with sufficient force to explode it, and having considerable mass it must have necessarily considerable inertia, so that it needs a deep notch in order to hold it firm at full-cock when jarred, and this deep notch necessitates a strong pull on the trigger. But with an electric gun, the circuit closing parts can be very small and light, and can be put into a recess in the butt of the gun out of the way of chance blows; so that when it is desired to fire, a very light pressure of the finger is all that is needed, and yet from the small inertia of the parts, a sudden shock will not cause accidental closing of the circuit and firing of the gun.

We have now taken a running survey of the uses of electricity in war, and we find that they include nearly all the uses to which electricity can be put. Warfare now means more than the mere handling and provisioning of troops and ships; it means, in addition, the intelligent employment of scientific instruments; particularly is this the case with naval warfare, for a modern ship considered as a whole is in itself the most elaborate, complicated, and powerful machine existing.

Science has made warfare a greater thing than scientists themselves foresaw, for it has put into the hands of our naval and military commanders weapons surpassing in power and length of reach the fabled weapons of mythology. Yet our wonder and admiration at what has been accomplished pale before our wonder and admiration at what will surely be accomplished. Progress is marching with rapid steps. Looking forward to the future with the light the past affords us, we see the promise of great things to come. Let us welcome each new triumph of the discoverer and inventor, and take advantage of every resource that science can suggest.

War is a sad necessity, but it comes seldom to a nation known to be prepared. Let us thoroughly prepare ourselves, then, if war does unfortunately come, we need not fear the issue.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Nov. 23, 1885.

Mr. J. M. Oram, inventor of the telephone time repeater, started on last Saturday for a trip South in the interest of his invention.

The Electrical Development and Manufacturing Company is enjoying a steady and growing demand for the Davis cut-out, of which this company has exclusive manufacture and sale.

The Jarvis Engineering Company are at the present time pushed far beyond the limit of their facilities, with orders from all sections of the country, to fit up electric light stations, and to erect new steam plants.

Mr. Wm. Whitney Munroe, Secretary of the Thomson-Houston International Electric Company, has been seriously ill during the past week, brought on by too close and zealous attention to the increasing business of his company. He is rapidly recuperating, however, and will probably be at his desk again in a few days.

The Thomson-Houston Electric Company have, since Sept. 15, 188, increased their system as follows:

A. C. Huston, Chicago	12	new.
Thomson-Houston Electric Light Co., Philadelphia	126	increase.
V. Q. Irwin, Crawfordsville, Ind	30	"
Milford Electric Light and Power Co., Milford, Mass.	45	new.
Toledo Electric Light Co., Toledo, O	90	"
New Haven Electric Light Co., New Haven, Conn.	135	increase.
United States Electric Light Co., Washington, D. C.	90	new.
Fall River Electric Light Co., Fall River, Mass	26	increase.
Columbus Elec. Light and Power Co., Columbus, O.	25	"
Forest City Carbon Co., Cleveland, O	6	new.
J. M. Starr, Richmond, Ind	38	"
Badger Electric Light Co., Chicago, Ill	45	increase
Cleveland Electric Light Co., Cleveland, O	60	"
Citizens' Electric Illuminating Co., Brooklyn	90	"
Kansas City Electric Light Co., Kansas City, Mo.	25	"
Citizens' Electric Light Co., Akron, O	70	"
C. H. Nettleton, Birmingham, Conn	45	new.
Champion Electric Light Co., Springfield, O	60	increase.
Bridgeport Electric Light Co., Bridgeport, Conn.	70	"
Danville, Va	60	new.
Middlesex Electric Light Co., Lowell, Mass	25	increase.
Peru, Ind	25	new.

The Ball Electric Light Company has placed a 24 arc light plant in the large clothing house of Messrs. Macullar, Parker & Co., No. 400 Washington street, this city. This system of electric lighting has also been introduced in the Clyde Bleachery and Print Works, at Riverpoint, R. I.

The Johnson Electric Service Company, manufacturers of electric specialties, with headquarters at Milwaukee, Wis., have established a New England Department, with offices at No. 27 Franklin street, this city; Mr. H. E. Jacobs, manager. The electric valves manufactured by the above-named company possess real merit, and have proven highly satisfactory wherever used, as is attested by a large number of well-known manufacturers and merchants, whose letters of indorsement of this valve appear in the handsome catalogue published by the company.

Mr. A. L. Russell, who now occupies the premises for so many years the New England quarters of the Western Electric Company, No. 101 Court street, continues the manufacture of the same line of telegraph and electrical instruments as formerly turned out under the management of Mr. Charles Williams, Jr.

On Thursday, Nov. 12, the organizers of the Chemical Electric Light & Power Company held a meeting at the headquarters of the company, No. 95 Milk street, for the purpose of electing a president and treasurer, which resulted as follows: Mr. Stephen M. Wells elected president, and Mr. J. H. Howard treasurer. The company have just commenced fitting up a factory for the manufacture of their apparatus for isolated incandescent lighting. It is located on Charlestown street, near the Fitchburg railroad depot.

The open circuit battery of Mr. T. L. Kauffer, of this city, is meeting with very satisfactory sale. Mr. K. states that since placing his advertisement in THE ELECTRICAL WORLD he has been receiving from twelve to fifteen letters daily, the major part of which contain orders for his battery. Another kind of battery manufactured by this gentleman, and known in the electrical field as the Kauffer patent gravity battery, is being exclusively used by the Boston Fire Department. As an illustration of the reliability of the last-named battery, six cells were placed on the private fire alarm of the Boston Safety Deposit Vaults on the 19th of February, 1885, and were run until Nov. 13 without attention or renewal, and during that time were constantly closed and gave perfect service.

The Taylor Manufacturing Company, of New Britain, Conn., is becoming extensively engaged in the manufacture of electrical apparatus. This company is making a new electric bell and a new line of annunciators.

The Electric Light Company, at Woonsocket, R. I., are erecting a new station, and have given the contract for the steam plant to the Jarvis Engineering Company, of Boston.

W. I. B.

PROVIDENCE, R. I., Nov. 24, 1885.

The Rhode Island Telephone and Electric Company report a steadily increasing demand for the "Little Giant" battery, which was recently placed in the market by this corporation. It is claimed for this battery that it cannot be destroyed by short circuit; that the carbons are practically indestructible, as they can be renewed by simply washing in pure water; and there is a great saving in the number of cells required, as compared with many other open circuit batteries now in use. This same company invites the special attention of purchasers of exchange outfits to its patented improved switch-board, which has given very satisfactory results wherever it has been used. The board is guaranteed up to 4,000 lines. The Wright patent cable clip, made by this company, which is now very extensively in use for the suspension of aerial cables, is kept constantly in stock in large quantities and at a price to suit the demand, and orders for same are promptly filled. The company was never in a more flourishing condition, or held a higher position in the esteem of the general public than it does at the present day; and every new enterprise into which it embarks, or any line of goods enjoying its support or indorsement, is certain to receive all the attention and favor that could be desired.

The Providence Fire Department has added to its fire alarm telegraph an automatic lightning arrester, which prevents injury to signal boxes by lightning or by the wires coming in contact with electric light wires.

The Narragansett Machine Company reports having a steady income of orders for its popular foot-power lathe.

The Providence Electric Supply Company is making a specialty of a very nice electric vibrator bell, which is offered at a remarkably low price. The bell referred to has a 2½ gong, platinum contact points, is mounted on an iron frame, with polished walnut base and box, and is adjusted to ring on one cell battery.

The gentlemen composing the R. I. Braiding Company were, I learn, the original makers of the double braiding machine for covering wire of all kinds, and Mr. Winchester, the president of the company, is the inventor of the first braider for making skirt braid. In justice to these enterprising gentlemen, it may be stated that the machines made by them are not permitted to go out of the factory until they have been thoroughly subjected to a rigid test under their personal supervision. The natural result from this care, foresight and keen business tact is that satisfaction is given, no machines are returned, and, better than all, a customer once gained by them never has occasion to place orders elsewhere.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Nov. 23, 1885.

The great sensation in telegraph circles last week was a lengthy letter from Norvin Green, President of the Western Union Telegraph Company, to "the Honorables the Mayor and Select Common Councils, of the City of Philadelphia," declining to accept the terms of a recent ordinance permitting the telegraph company to dig up the streets for the purpose of putting its wires underground. The law provides, as has been explained before in these columns, that all wires must be placed underground before the first of January next. None of the companies could comply with this law, because, until recently, it would be unlawful to dig up the streets. This fault was remedied by the passage of an ordinance, which was approved on the 12th of October, granting the necessary permission to open the streets. This action, it was supposed, settled the underground question, as all the companies, or most of them, seemed very anxious to begin the work; although, in view of the lateness of the season and the near approach of frost, when the necessary effodient ceremonies would be impracticable, it was not expected that much work could be done before spring-time. At all events, the underground question itself was considered settled, the only question open being the length of time required to complete the job and put the present 5,000 miles of aerial lines out of sight. But, on the 19th inst., all calculations were knocked in the head by the receipt of Dr. Green's letter, declining to "accept" the terms of the city. The objections made by Dr. Green are so reasonable and so clearly defined, that the underground millenium has been postponed for a considerable time. Dr. Green's chief objection is beyond argument. The ordinance demands, among other stipulations, that the various companies shall faithfully comply with "ordinances now in force, or which may hereafter be passed." This, Dr. Green very properly observes, goes entirely outside of the subject matter of the privileges granted, and appears to provide for an undertaking by his company, and by the several companies, to comply with all ordinances now in force, or which may hereafter be passed, whether lawful or unlawful, reasonable or unreasonable. It appears, he says, to be an obligation of the several companies and their sureties unlimited in amount and unending in duration, and appears to be a waiver or relinquishment by his company, and by the several companies, of all rights and franchises under the laws of the State of Pennsylvania, or of the United States, and a stipulation of complete surrender to the power and discretion of the city government. There is great danger, he says further, that the courts would hold that acceptance of the ordinance and execution of the obligation was complete relinquishment of all rights and franchises other than the city chose to give, and on such conditions as the city chose to impose.

Dr. Green explains further that his company is most anxious to meet the views of the city authorities; that it has already ordered the necessary tubes and insulated wires, but that he cannot accept the restrictions named by the city. He concludes with the statement that his company has been called upon to lay, and has laid, a great number of underground wires in New York, Boston, Chicago, and other cities; but in no instance, except in Philadelphia, has the action of the city officials permitting the opening of the streets for such purposes been accompanied with any conditions beyond those of the manner and responsibility of and concerning the particular work authorized, and that the company has nowhere, except in the case of this particular ordinance, been asked to sign away any rights or relinquish any franchises held or claimed under the law.

It is the general impression here that Dr. Green has entirely the best of the argument.

The recent "Novelties" Exhibition was not a great financial success. The admissions, which numbered about 143,000, brought the sum of $43,000—a trifle over and above the expenses. Between 400 and 500 exhibitors had space in the building. A partial list of the awards has been made public, but as the exhibition was one strictly for "novelties," the electricians do not figure very prominently. High honor—a silver medal and reference to the Committee on Science and Art for further award—is, however, accorded to the Edgerton Motor Company for an electric motor.

The American Electric Construction and Supply Company, late of No. 125 North Seventh street, this city, which assigned some time since to Alfred F. Moore, the large wire manufacturer, is about making a settlement. Mr. Moore is nearly ready to file his final account, and says that he expects to pay all claims in full.

The government's new "rapid" delivery system does not thrive as well as expected, and its operations have had no effect whatever upon the local telegraph, telephone and American District systems.

Mr. W. P. Tatham, President of the Franklin Institute and one of the firm of Tatham Bros., the large lead manufacturers of this city and New York, gave me, a few days ago, some very interesting facts relative to the first lead-covered underground cable ever made in this country, and the reason of its non-success then. Mr. Tatham says that forty years ago, when Congress appropriated $40,000 for an experimental line of telegraph between Washington and Baltimore, to be constructed under the supervision of Professor Morse, they contracted with Morse to furnish 35 miles of lead-covered cable with four copper wires wrapped with different-colored cotton (to distinguish the different wires) and insulated with shellac, and then inserted into the lead pipe. There was another firm who had contracted to supply some cable of the same dimension as the Tatham's, and two experts were appointed to examine the working of the cables. These were Professors Fisher and Leonard R. Yale. The cable made by the other firm was laid first, and in a few days was found to contain water. Mr. Tatham accounts for this by saying that the lead pipe was not completely filled by the wires after insertion, and that a place was left for the air and moisture to circulate, and also that the lead in being put on was likely to have had holes in it. At least, the plan of underground wires was abandoned, and the poles were brought into use. The Messrs. Tatham have a process for covering cable with lead which is receiving great encomiums from those conversant with the difficulties of the task.

It does not look very much as though the wires will be removed from the poles here, as one continually sees gangs of men stringing new wires on the tall poles which line the sides of the numbered and cross streets. While this is the usual scene on the cross street, there is a show being made on the principal thoroughfares of putting down some cables. The Electric Light and Power Company have been engaged during the past week in connecting their office on South Eleventh street with some down-town stores and offices.

All the electric light companies report business as very good, and one readily believes it as he sees the many new plants in and about the city.

There will be several lectures given at the Franklin Institute during the winter on electricity and its use, all of which should be heard by Philadelphians interested in this subject.

We are glad to see that J. Chester Wilson, of the Clark Insulated Wire Company, has recovered from the affection of his eyes, which has kept him from tending actively to business.

E. F. I.

THE TELEGRAPH.

Heathenish Names.—If the nations of Eastern Europe had a particle of sympathy for telegraph operators and telegraph editors, they would never fight. The heathenish names from that country are enough to make a needle cross-eyed.—*Denver Tribune.*

Manhattan District Telegraph Company.—A notice has been issued by President D. H. Bates, of the above

company, informing all the employés that Mr. W. E. Huntington has been appointed general superintendent.

B. & O.—The indebtedness of the Baltimore & Ohio Telegraph Company to the Baltimore & Ohio Railway is stated at $3,872,693. A dispatch says that the Telegraph company has given bonds for that amount to the Railroad company.

A Lineman Lassoed by a Locomotive.—At Harrisburg, Pa., on Nov. 19, A. L. Dunn, a telegraph lineman of the Pennsylvania Railroad Company, while stretching wires, had a coil of wire around him, a line of which crossed the railroad track. A shifting engine caught the wire and threw Dunn thirty-five feet into the air. He came down on the back of his head, crushing in his skull at the base of the brain.

Rumor.—A conference of Western Union and Baltimore & Ohio people is said to have been arranged, and Western Union officials are reported summoned for consultation, etc. On the other hand, it is declared that the relations between Baltimore & Ohio and Western Union are not so friendly that the chances of lower rates are much stronger than those of higher rates, and that, while the prices may not go down in the face of a strong market, it would be as well to buy as anything else.

Cyrus Field Sues Editor Bennett for Jumping on Him.—A dispatch from London, dated Nov. 17, says: Mr. Cyrus W. Field has sued Mr. James Gordon Bennett, proprietor of the New York *Herald*, and Mr. A. Oakey Hall, his London correspondent, for £10,000 damages for libel in publishing a cable dispatch dated London, Feb. 4, stating that "Mr. William Abbott, broker and operator, of Tokenhouse Yard, supported by many stockholders of the Anglo-American Cable Company, announces that at the Friday meeting of the directors of the Anglo-American Cable Company he will introduce a resolution to expel Mr. Cyrus W. Field from the directorship on the ground that he is unworthy of any position of confidence or trust."

THE TELEPHONE.

A Ball at Kansas City.—We have received an invitation to the ball of the Kansas City Employés of the Missouri & Kansas Telephone Company, to take place on Dec. 10. The invitation cards are beautifully printed, and from what we know of the way they do these things down there, we can predict a most enjoyable evening. The direction of the affair is in the able hands of Mr. D. B. Macquarrie.

Railway Telephony.—For some time, say western papers, there has been in course of construction, on the narrow-gauge track between Paw Paw and Lawton, Mich., a telephone line, by means of which a moving train could be in communication with stations in either direction, or with other moving trains. The line is now completed and the trials made are reported to be satisfactory. One difficulty had to be removed by trial, namely: Whether the contact of a rod moving swiftly along the wire would be steady enough to transmit an even current. The working of the apparatus described proved so satisfactory as to surprise the most sanguine. Conversation in the cars while running at a rapid rate was held with the stations on either side with no more difficulty than between two common telephone stations. It is reported that the Union Pacific officials are coming there shortly to investigate the workings of the apparatus, preparatory to putting it into use upon their road.

News from the Front.—A special despatch of Nov. 19 from Washington says: "The opponents of the Bell Telephone Company profess to be very confident that the decision of the Interior Department will be in their favor. They admit, however, that they have not received any intimations which would warrant them in making any positive statement. They do not understand that the board will enter upon the consideration of the case until the expiration of the 10 days' limit within which permission has been granted to all parties to file briefs. The briefs and the record on both sides will be very long, and it is not expected that the record for the petitioners can be furnished to the department in less than a week. The fact prominently brought out since the hearing is that Prof. Elisha Gray will undoubtedly endeavor to secure a patent for a speaking telephone on the ground that the invention is his alone. Patent lawyers insist that he has no rights unless he can affirmatively establish the fact that there was fraud and collusion in obtaining the Bell patent."

The Value of Erie.—In reply to inquiries as to the prospective effect on Erie of an adverse decision against the Bell patents in the suits now on trial in Washington, our opinion, says the Boston *Commercial Bulletin*, would be that the Erie Company will be benefited whichever way the matter turns. If the Bell patents are invalidated, the Erie Company will be relieved of the heavy rentals which it now pays the Bell Company. On the other hand, if the patents should be emphatically sustained, then the Erie Company will insist that the competition which it suffers in Texas from the companies who are now fighting the Bell Company shall be rigidly suppressed. The Erie has not been getting the revenue from Texas that it ought to, and we trust its vigorous management will take strong ground, either that the Bell royalties shall cease or that the Bell Company shall protect it in receiving from the great State of Texas the revenues which belong to it. If the Erie Company were receiving what it ought to from Texas to-day, it would be already earning 5 per cent. upon its stock instead of 3½.

THE ELECTRIC LIGHT.

New Haven, Conn.—The New Haven Electric Light Company received last week their 50 h.-p. Armington & Sims engine. They have also set the second tubular boiler with the Jarvis furnace.

Schenectady, N. Y.—The Schenectady Gas Company, Schenectady, N. Y., have decided to add an electric light plant. They have given the contract for the engine and boiler, with all the steam machinery, to the Jarvis Engineering Company, of Boston.

A Little Poker Debt.—Mr. Richard L. Hull went to Washington to push an electric light and took a hand there in a little game of poker at the house of a friend. He lost $3,000, and now declines to meet the notes he gave. He is defendant in one suit in this city on a note for $300. He claims that he was "steered against a crooked game."

Lawrence, Mass.—A meeting of the committee on streets was held, on Nov. 17, to consider the petition of 600 residents of ward 6 to have arc lights retained on the bridges and railroad crossings between North Lawrence and South Lawrence. All present were unanimous in favor of retaining them. At the close of the hearing the committee voted to accept the proposition of the Lawrence Electric Light Company to furnish all lights which may hereafter be required on the bridges, the Common and the public streets, at $10 per month each. About 20 arc lights are now in use.

Foot-ball by Electric Light.—Mr. Charles Lever lighted the foot-ball field at Tunstall, England, on the occasion of a recent match, with six of his arc lights of 2,000 nominal candle-power, each placed on poles about 80 feet high, and provided with specially arranged globes to reflect the light, and the ground was said to be effectively lit up. The same evening, 10 similar lights were used to illuminate the Market Hall, wherein a promenade concert was held. The following night a ball was given in the Town Hall, and five lights lit up the front of the building. An engine had been provided in some neighboring mills for working the special Gramme dynamo, but Mr. Lever found it advisable to use a portable engine in addition, the work being divided between the two.

Growth in New England.—The growth of the electric light system in Manchester, and in other places as well, says the Manchester (N. H.) *Union*, is remarkable when one comes to consider the brief period that has intervened since this invention was first introduced. At the present time the Amoskeag Manufacturing Company has in operation about 550 large lights, and the Amory Manufacturing Company has over 250 incandescent lights. The Manchester Electric Light Company is at present engaged in putting 10 large lights in the P. C. Cheney Paper Company's mills, and the former has at present in operation nearly 150 lights. The streets of several New England cities are almost wholly lighted by electricity, Lowell, Boston and Portland being noted for this, and a contract has recently been made to light the entire city of Lawrence by the same system. The thriving village of Laconia has a large incandescent plant.

The Towers of Savannah.—The high electric light tower at the intersection of Liberty and Habersham streets, says the Savannah *News*, of Nov. 16, fell with a tremendous crash at 6 o'clock last night. The fall was caused by a runaway mule striking the tower. No one was hurt. The towers were put up about three years ago. They are anchored in a foundation of brick and cement, and were considered very strong. This tower is the third one that has fallen in Savannah. One at Huntingdon and Price streets toppled over before it was finished. About a year ago a freight car in the Central Railroad yards jumped the track and crashed against the tower by the passenger shed, bringing it down. Two or three of the structures are 185 feet high. They are ascended by an automatic elevator, which, when not in use, is kept locked a few feet above the ground. Some months ago a painter who had been coating one of the towers got out of the elevator cage before fastening it. The cage at once started for the top, gaining in speed the higher it went. When it struck the top platform the whole top was broken off. Not long ago a tower in Macon was knocked down by a mule.

APPLICATIONS OF POWER.

Worcester, Mass.—Steps are being taken to complete the organization of the Worcester Electric Power Company, which will employ the Daft system. The company has secured a building in which to install its plant, and Mr. E. E. Harthan has been made superintendent. Power will be distributed for manufacturing purposes, and it is proposed to build and operate an electric street railway between Main street and Washington square.

Daft's "Divine Discontent."—"There is a grave suspicion abroad," says the New York *Tribune's* Man About Town, "that Cyrus W. Field and others of the Manhattan Company have been satisfied with the success of the Daft electric motor for some months past, and that it was really the inventor who was in anything like doubt. And his was dissatisfaction with what he had accomplished only because of his firm faith in the idea that he could soon attain higher results by repeated experiments. I have heard it suggested that there was a probability of an early test of this motor on the New York Central and Hudson River Railroad."

PERSONALS.

Mr. C. N. Fay, of the Chicago Telephone Exchange and President of the National Telephone Exchange Association, is expected shortly in New York.

Mr. G. F. Durant, of St. Louis, is East, and has been staying in Brooklyn. He has succeeded in putting the St. Louis Exchange in first-class shape again after the late fire.

Gen. C. H. Barney is just back from New Orleans, where he has been attending to his duties as a Commissioner for New Jersey. He says that the Exhibition is a good one and will be in shape by the beginning of January. With regard to the report of the National Telephone Exchange Association, he says that it will be out in a few weeks. It will be one of the most interesting of the series.

MISCELLANEOUS NOTES.

A. I. E. E.—A general meeting of the American Institute of Electrical Engineers is announced to be held at the House of the Civil Engineers, 127 E. Twenty-third street, this city, on the 8th prox. at 1 P. M., primarily to discuss amendments of the by-laws, and next to hear any papers presented. We hope there will be a good attendance.

A Popular Engine.—Among recent sales of Ide engines are the following: Jenney Electric Company, Indianapolis, Ind., one of 60 h.-p. for the new factory; United States Electric Lighting Company, Chicago, one of 40 h.-p., two of 60 h.-p., one of 100 h.-p., one of 125 h.-p., for lighting the Cook County Buildings; Fort Worth Ice Company, one of 80 h.-p., for electric lighting.

Gift to a College.—The science cabinet of Seton Hall College, at South Orange, N. J., has been enriched by a valuable collection of electrical and scientific apparatus given by Edward Kelly, son of Eugene Kelly, the banker. For a long time the college faculty have felt that work in the science department was retarded by the incompleteness of the apparatus. Mr. Kelly's gift supplies everything that is needed. The collection was made by him during his student life in England.

Visiting Statesmen.—A special dispatch from Chicago, of Nov. 23 says: The New York City Commission on Electrical Subways is in the city investigating the Chicago conduit system. The commission has visited Philadelphia and Washington. Before starting out on practical investigation, over 100 plans were received of all grades of usefulness. Speaking of what the members had seen in Chicago, Commissioner Hess said: "It seems to be a practical, common-sense idea, and the only question is about its withstanding moisture. Chicago has much more of a system than the other places we have visited, and the test here is much more thorough." The commission will finish its investigations to-morrow.

A Standard Volt.—In 1862 M. Gaiffe remarked that the strength of the solution in chloride of silver batteries influenced their electromotive force, a stronger solution giving a smaller electromotive force. Acting upon this hint he has constructed a cell with a solution containing 5 per cent. of chloride of zinc, which gives an electromotive force of 1.02 B.A. volts, or 1.01 C.G.S. volts. It is necessary to employ pure materials, in order to keep the electromotive force of the standard cell constant. The temperature ought also to be kept constant during the time of observation, and to be the same degree in the various observations. Working with well-amalgamated zinc, pure melted chloride of silver, limpid solutions of pure chloride of zinc as neutral as possible and at the temperature of 18 deg. Cent., M. Gaiffe finds that the same solution always gives the same electromotive force. The liquor marked 107 by the densimetre appears to give the legal volt. In using the cell, resistances of at least 5000 ohms should be used to prevent polarization.

Trees and Lightning.—Mr. Percy Smith writes to the London *Times* that "the most probable cause of the liability of certain trees to be struck by lightning is that they are bad conductors of electricity. The suggestion that oak trees are struck because they contain iron is both erroneous and absurd. If oak did contain iron, it would, in all probability, increase its conducting power and act as a preservative. If oak contained an estimable quantity of that metal, the wood would turn black on exposure to air, on account of the tannin which is present. This blackening may be seen surrounding the iron nails in any oak fence. The contour of the ground, nature of the soil and the presence or absence of water have more influence in deciding the locality of an electric discharge than the height of a tree. Add to this the difference in the conductibility between various woods, and we have at once an explanation of the apparent peculiarity of tall trees escaping unharmed while shorter trees are destroyed."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., a 29; Am. Cable, b 68¼; B. & M., a 5; Western Union, b 77⅛, a 77¼.

Telephone.—Am. Bell, b 171, a 172; Erie, b 28, a 28¼; New England, b 28.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Detroit Electrical Works.—We have a circular from Mr. Fred. H. Angell, announcing that as the manager of the Eastern agency of the Detroit Electrical Works, he has taken offices at No. 30 Astor House building, this city, where he is now prepared for business.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden lane, New York.

Armington & Sims' Engine Catalogue.—One of the most artistic catalogues which has ever come under our notice is that just received by us from the Armington & Sims Engine Co., of Providence, R. I. It gives a full list of sizes and powers of their excellent engines, and should be in the hands of every power user. It is not only an excellent practical book of reference, but in addition a veritable *édition de luxe*.

Business for Sale.—A well-established electrical novelty, light and dynamo manufacturing company, with general business, is prepared to sell out and to make very low terms with a cash purchaser. Included in the offerings are some patents said to be worth alone the price that stock, supplies and everything are offered at. The parties selling have other enterprises on hand, and hence cannot give this electrical business the attention it demands. See card "Wanted" in advertising columns. Address "A," this paper.

The Belt They Like.—The Harrisburg, Pa., Electric Light Company writes as follows to the Shultz Belting Company, under date Oct. 3, 1885: "We have no fault whatever to find with the belts; and while the price of them is very much higher than other first-class belts which we could have purchased, we believe these to be the cheapest in the end, as we have had no evidence whatever of any slipping on the pulleys, all the power of the engines being transmitted to our dynamos by the use of these belts, which, in incandescent lighting, is a very important matter, and against which a few hundred dollars invested in belts of a quality suitable for the purpose is no consideration." These Shultz belts, it will be remembered, are made of leather tanned only on the surfaces. The interior of the hide, which is the fibre, is raw hide, softened and made pliable by a patent process.

German Corn Remover
Kills corns and bunions, unfailing, rapid, painless; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
GALE'S HONEY, the great cough cure; 25c., 50c. and $1.
HLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

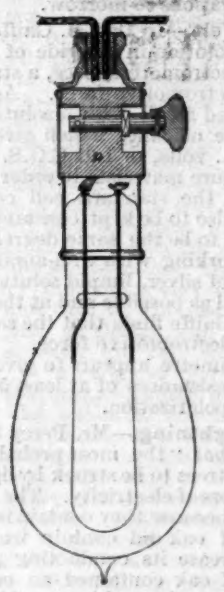
PATENTS DATED NOVEMBER 10, 1885

Electric Conduit; Henry L. Cuples, and Wilber W. Lewis, Kansas City, Mo..... 329,887

Consists in a conduit for electrical conductors, of a hollow curb provided with a cover united thereto by means of a rabbet in one side and a lap-joint on the other, a series of projections upon the interior of said curb, and independent removable supports upon such projections, said supports having depressions therein for holding the conductors.

Telephone Cabinet; Frank G. Johnson, New York, N. Y..... 329,909

The cabinet shown in use in the cut and for the purpose



330,269.—HOLDER FOR INCANDESCENT LAMPS.

of securing secrecy, consists of sounding boards lining the cabinet, multiple walls and ceilings with air spaces between, and triple windows.

Electro Medical Apparatus; Amandus Metzger, New York, N. Y..... 329,929

Consists of a primary and secondary circuit, the latter having a condenser interposed therein.

Arc Lamp; George G. Pyle, Cuyahoga Falls, O., Assignor to the American Electric Headlight Co., Indianapolis, Ind..... 329,948

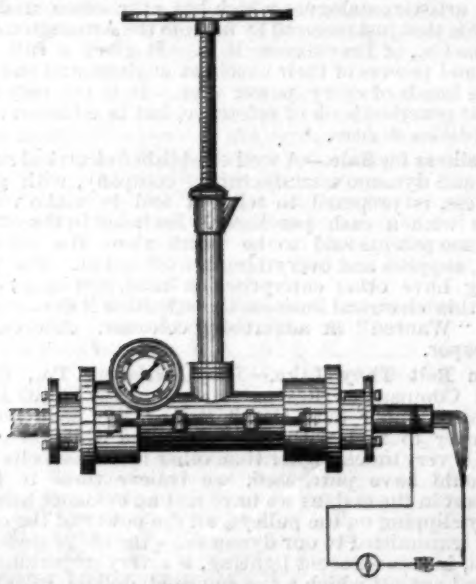
Consists, essentially, of a sliding plate or frame carrying a roller mounted in movable bearings and a pair of opposing or bearing rollers between which the carbon is conducted, an electro-magnet acting to first close the movable roller upon or against the carbon and thus grasp the latter, and to raise the sliding plate, its attached rollers, and the carbon held thereby, and an actuating mechanism applied to drive one of the clamping rollers, and thereby effect the feeding of the carbon.

Combined Telegraphic and Telephonic Circuit; Abner M. and Thomas R. Roseburgh, Toronto, Canada..... 329,956

Consists in the arrangements of circuits and instruments whereby secondary or induced currents are sent to line, and the home receiver is so connected as not to respond to messages sent from the home transmitters, but will respond to messages sent from the distant station at the same time the home transmitter is in operation, and in the combination of a duplex secondary or induction system with an ordinary Morse system.

Telephones; William A. West, Bellefontaine, O., Assignor to the West Telephone Co. (Limited), Kenosha, Wis.....(1), 329,982; (2), 329,983; (3), 329,984

(1) He provides the receiver with a permanent magnet of horseshoe form, one pole being placed in contact with the diaphragm, and the other pole arranged opposite the



330,048.—METHOD OF TESTING ELECTRIC CABLES.

vibratory part of the diaphragm, and being wound with a primary helix in a local circuit including the fixed and movable contacts and primary of the inductorium of the transmitter, and also with a secondary helix in circuit with the secondary of such inductorium and with the line.

(2 and 3) Are essentially for a method of controlling the vibratory movement of the movable contact of a telephone, consisting in subjecting the same to an attractive force called into action by the separation of the two contacts, and influencing at that time the movable contact to move in a direction to re-establish the normal condition of the circuit in which it is included.

Automatic Circuit Closer; Patrick C. F. McCambridge, St. Albans, Vermont..... 330,037

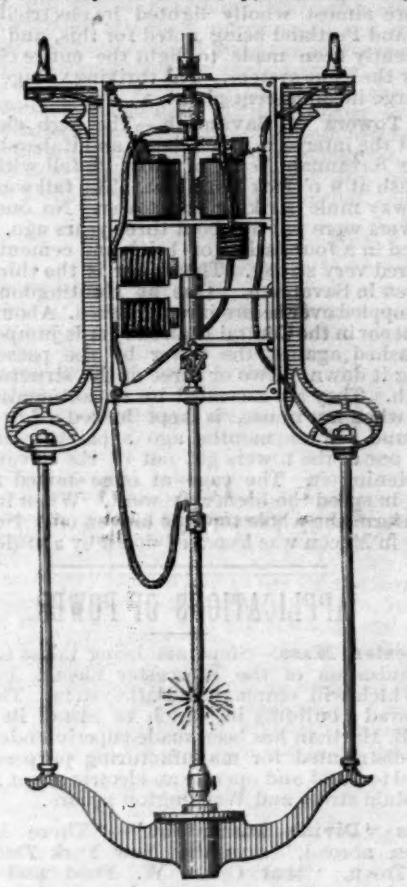
The key has a spring in connection therewith, and a lateral movement, all of which can be readily attached to any telegraph-key, and on either side of the finger-button, according as the operator may be right or left handed, and no change is required to be made in the ordinary manipulation of the finger-button, inasmuch as the end of the operating lever is directly where it would be most naturally pressed toward the centre of the button, and thus automically open the circuit in the act of telegraphing, and this without resorting to any difficult or inconvenient effort.

Testing Electric Cables; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Co., of same place..... 330,048

Consists in pressing water about the joint and gradually increasing the temperature of the water, and at the same time observing a galvanometer included in the circuit of the wires of the cable, as shown in the cut.

Splice for Cables; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Co., same place..... 330,049

Consists in providing a Y-joint at the man-hole of the conduit in which the cable is placed, and in providing sufficient slack in the cable so that the repairer may lift the joint to the surface and make such repairs, tests, and connections as may be necessary, thus obviating the ne-



330,055.—ELECTRIC ARC LAMP.

cessity of making the man-holes large enough to permit the repairer to work therein with tongs and other tools which are required.

Electrical Devices; Charles E. Scribner, Chicago, Ill., Assignor to the Western Electric Co., same place..... 330,052 to 330,066

The first relates to an arc lamp, and includes a spring inserted beneath the ordinary ring clutch and a stop above the same; the second to a dynamo, which has a switch for diverting the current from the commutator through a shunt to the main circuit; the third to a lightning arrester, in which he provides means for detecting the location of a fault; the fourth is shown in the cut, and includes a carbon tension regulator, in circuit with the lifting magnet; the fifth to telephone battery circuit, which is an improvement upon his patent 243,165, June 21, 1881, where he employes a Wheatstone bridge; the sixth, to telephone exchange signal, which consists of an induction-coil and telephone lines, one through each of the coils, and an annunciator-drop operated by the soft-iron core of the induction-coil when energized by current sent over one of the telephone lines; while the remainder relate to telephone switch-boards, which comprise improvements in the details of construction.

Telephone Switch-board; John A. Seely, New York, N. Y., Assignor to the Western Electric Co., Chicago, Ill..... 330,067

Consists in distributing the calling-annunciators of the different subscribers in uniform groups upon the different boards, and in providing extra sets of switches or spring-jacks for each group of annunciators, so that when an annunciator is thrown down a spring-jack in the line may be found always within easy reach and in a given position with respect to the said annunciator.

Conductor; Anson C. Tichnor, San Francisco, Cal..... 330,071

Improvement upon his patent 300,410, June 17, 1884.

Locomotive Alarm; William Vogel, Chicago, Ill., Assignor to Adolph Zeller, same place..... 330,074

Consists of a number of electrical contacts, corresponding to the number of tracks with which the switch connects, and which are electrically connected to a corresponding number of contacts which are placed at the switch, a switch-rod which is connected with the ground-battery, and which is provided with a device for resting upon one of the contacts, a ground-battery which is connected to the rails of the main track, and a suitable operating mechanism placed upon the locomotive for the purpose of sounding an alarm and exposing a sign or signal to the engineer, showing whether it is safe to proceed or not.

Dynamo Electric Machine; Ernest P. Clark, Owego, N. Y..... 330,095

Relates to that class of dynamo having external and internal pole-pieces and magnets. The poles-pieces are connected to a common magnetic distributor of soft iron, and the external field-magnets are so placed that they are in line with both sets of pole-pieces.

330,139.—ELECTRIC LARYNGOSCOPE.

Electric Laryngoscope; Curt W. Meyer, New York, N. Y..... 330,139

The object is to provide a new laryngoscope, which illuminates the mouth and larynx, and at the same time holds down the tongue. Consists, as shown in the cut, of the combination, with an incandescent electric-lamp mounting having a ball provided with a transverse insulating-piece, of a socket for receiving said ball and of contact-wires passed through the socket and resting against the surface of the ball, whereby the ball can be turned in such a manner that the ends of the layer of insulating material passed through the ball are in contact with the conducting-wires, thus cutting out the lamp, or the ball may be so turned that the contact parts of the ball are in contact with the conducting-wires.

Plating with Palladium; Gaston P. and Clément Carry, Besançon, France..... 330,149

Consists in introducing into a bath containing chloride of palladium, phosphate of ammonia, and an alkaline substance, such as phosphate of soda or liquid ammonia.

Electric Wire Support; John W. Tringham, Windsor, Canada..... 330,173

Consists of a conical-shaped, bifurcated, and exteriorly-threaded pin having a shank, in connection with a conical screw-cap constructed to screw on said pin and force the arms of the pin toward each other.

Testing and Firing Apparatus for Submarine Mines; Joseph S. Gibbins, Westcombe Park, Assignor to Latimer Clark, Westminster, England..... 330,226

Contact-springs are supported on the cast-iron base so near to contact with an insulated disc that the contact-screws on the disc strike the said springs and close the circuit whenever the mine receives a blow.

Underground Electric Wire System; Thomas D. Williams, Belleuve, Assignor of one-fourth to John M. Boggs and William R. Kirkpatrick, both of Pittsburgh, Pa..... 330,227

Consists of manholes, outer pipes, pipes having their ends

329,909.—TELEPHONE CABINET.

surrounding side holes in said manholes, and interior pipes having their ends in said holes, all combined and arranged to form a water-passage between the pipes, and emptying into said manholes.

Electric Lamp; William Stanley, Jr., Pittsburgh, Pa..... 330,269

As shown in the cut, the bulb neck has an annular projection adapted to fit into a groove *b*, formed in a split tube *A*, of resilient metal, and to press upon spring terminals E_3 and E_4, of an electric circuit.